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THE ASCOCARPIC STAGE OF SPECIES OF SCOPULARIOPSIS

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(WITH PLATES 25–28)

INTRODUCTION

The asexual fructifications of ascomycetes are as often as not misleading when it comes to determining relationships. *Monilia* may be the conidial stage of certain species of *Sclerotinia*, a discomycete, on the one hand, or it may be connected with species of *Neurospora*, a pyrenomycete, on the other. *Botrytis* may be the asexual stage of certain other species of *Sclerotinia* in one case, but be connected with a *Lachnea*, quite a different type of discomycete, in another case. Much of our knowledge of the morphology of the ascocarp of *Aspergillus* and *Penicillium* dates back to the time of de Bary, Zukal and Brefeld, and to the cytological work of Fraser and Chambers and of Dale. The group Plectascales may be a heterogeneous one including forms of doubtful relationship. Should *Thielavia* as represented by *T. basicola* and *T. terricola* be included along with *Aspergillus* in this group? Neither species of *Thielavia* has a conidial stage and their carbonaceous ascocarps are quite unlike those of either *Aspergillus* or *Penicillium*. The disposition of the ascogenous hyphae and asci is such, however, as to suggest in a general way a relationship.

The writers have recently had under observation two species of ascomycetes which in the manner of the origin and development of the ascogenous hyphae and asci, taken in connection

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with the type of ascocarps and conidial stages, seem to furnish evidence bearing on this point, and indicate a relationship between such forms as *Penicillium*, *Scopulariopsis* (*Acaulium*), *Thielavia*, *Microascus*, and *Chaetomium*. Although the gap between the Plectascales and the Sphaeriales here is a very narrow one, the differences between the ascocarps of *Scopulariopsis* and *Chaetomium* are such, no doubt, as to warrant their separation.

Among the species of fungi isolated from roots of strawberries affected with the disease known as "dwarf" were two of particular interest. One was a species of *Thielavia*, referred to above and first described as *Coniothyrium terricola* by Gilman and Abbott (**10**). Emmons (**8**) has, however, proved that what were taken for pycnidia were really ascocarps. Unless one studies rather young material he is apt to fail to see the asci which deliquesce very quickly leaving the ascospores massed together within the cleistocarpous fruit body. In this condition the spores might easily be mistaken for pycnospores. The second species was noteworthy because of the way the little black fruit bodies discharged their coffee-brown spores in long contorted cirrhi. As not many ascomycetes discharge the spores from their perithecia in this way, one might think that here too the fruiting structures are pycnidia, especially as at the time when the spores are being discharged freely, asci are not readily distinguished.

Very similar to the latter was one of the fungi cultured by Kesten (**13**) from a superficial fungus infection occurring on the feet and legs of a Porto Rican. Three fungi were found in cultures from the lesions. On group study at the Mycology Laboratory these fungi were found to be *Epidermophyton inguinale*, *Geotrichum candidum*, and a species of *Scopulariopsis*. The *Epidermophyton* was probably the cause of the skin lesions. The other fungus cultures secured from this case very likely developed from spores which chanced to be present on the skin. The second species will not be considered further. The third species, by the character of its conidial fructifications was recognized as a species of *Scopulariopsis* some species of which cause disease. *S. cinerea* to be mentioned later has, for example, sometimes been found causing a disease of the nails. The fungus

had other very interesting characters as will be pointed out, and it was very kindly turned over to the authors for further study. These two fungi, the one isolated from strawberry roots, the other from a skin lesion form the subject of this paper.

RELATED PLECTASCALES

Two new species of fungi described by Zukal (**22**, **23**) as growing on dung or other refuse were included by him in a new genus *Microascus*. *M. sordidus* is a very small reddish-brown pyrenomycete with a papillate ostiole which may sometimes develop a short neck as is shown in his figure, copied in Engler and Prantl, who place this genus among the Aspergillaceae. The ascospores are reddish-brown, elliptical, rounded at both ends, inequilateral and 9–9.5 × 5.5–6 μ. Zukal says of one characteristic: "Die reifen Sporen werden bei diesere Species rankenförmig aus dem kurzen Halse hervorgepresst und bilden ausserhalb des Fruchtkörpers lange, röthliche kantige Schnüre." Zukal does not mention any conidial stage connected with the two species he described.

Massee and Salmon (**18**) in their studies of coprophilous fungi describe two species which they place in the genus *Microascus*. Their *M. variabilis* has ascospores very similar in shape to those of *M. sordidus*, but they are much smaller, being only about 3–3.5 μ long. No conidial stage is mentioned.

Bainier in 1907 (**1**) created a new genus, *Scopulariopsis*, with *Penicillium brevicaule* Sacc. as the type mainly on the basis of differences in the conidia and the form of conidiophore branching between this species and a true *Penicillium*. *Scopulariopsis* is discussed at some length by Thom (**21**) who is inclined to agree with Bainier, holding particularly that species showing a collar at the base of the conidium with germination through a basal germ pore, should not be included under *Penicillium* proper.

Sopp's monograph of the *Penicillium* group (**20**), 1912, was evidently published without knowledge of Bainier's work. With the group species, *P. brevicaule* also in mind, Sopp makes a new genus, *Acaulium*, which would have no particular standing were it not for the fact that three of his new species have very characteristic ascosporic stages. The very close resemblance of

these forms and the species of *Microascus* already mentioned raises a further doubt as to the validity of the generic name created by Sopp. Thom (**21**) discusses the seven species of *Acaulium* in his chapter on *Scopulariopsis* but still using Sopp's genus name. According to Sopp, *Acaulium albo-nigrescens* in culture shows a snow-white mycelium with long chains of oval or oblong white conidia. The ascocarp is a very small, black, spherical to pear-shaped structure with a distinct ostiole. The asci are spherical. The coffee-brown ascospores, when mature, are discharged in such abundance as to change the color of the old culture from black to brown. The spores are kidney-shaped, about $6 \times 4\ \mu$, cemented together in clumps with a substance which hardens and is not readily soluble in water. The spores separate quickly, however, in a drop of potassium hydroxide or acetic acid.

The one new species of *Dactylomyces*, so named by Sopp because of the finger-like conidial heads, grows best at about 40° C. The perithecia of *D. thermophilus* are reddish-brown, globose, and about 1/2 mm. in diameter. The wall cells are very large and angular. The oval to globose asci deliquesce, and the small yellowish ascospores escape through a very fine ostiolar opening. Sopp thinks this species may possibly be the same as *Thermoascus aurantiacus*, described by Miehe (**19**). Both species are reported as growing best at high temperatures.

Émile-Weil and Gaudin (**7**) report finding in several cases of infected great toe a new species of fungus, *Scopulariopsis cinerea*. Small black globose perithecia developed in their cultures. The oval asci deliquesced early, leaving the spores, which were brown, plano-convex, $6\text{–}7 \times 3\text{–}3.5\ \mu$, free in the perithecial cavity. No ostiole was mentioned, but if it were no more conspicuous than the ostiole of *Dactylomyces* figured by Sopp, it might escape notice.

Lechmere's (**14**) *Peristomium desmosporum*, described in 1913, also recalls Zukal's *Microascus* by the way the reddish-brown ascospores, united by some cementing substance, are discharged in long cirrhi, and by the general form of the perithecium, asci and spores. The conidial stage, which Lechmere obtained only from a particular strain, is described as of the verticillate

type. His figures are not unlike those of certain species of *Scopulariopsis* with reduced spore chains. It was, however, the manner in which the ascospores were discharged in long cirrhi that attracted his attention and suggested the specific name *desmosporum*.

Thom also points out that *Scopulariopsis candida* (Pers.) Loubière (*Monilia candida* Pers.?), connected by Loubière (**15**) with an ascomycetous stage described as a new genus and species, *Nephrospora Mangini*, might well be the same fungus described previously by Sopp as *Acaulium albo-nigrescens*. A recent comparison of cultures of these species obtained from the Baarn Culture Laboratory indicates, however, that they are not the same.

Besides four species of *Microascus*,[1] we have, then, *Acaulium albo-nigrescens*, *Peristomium desmosporum*, *Scopulariopsis cinerea*, *Nephrospora Mangini*, and the two forms studied by the writers, all of which are clearly so closely related as to warrant their inclusion in one genus, were it not for the conidial stage, now present, now absent. The writers are not particularly concerned to attempt to straighten out such a taxonomic tangle, even if all the facts relating to the questions of morphology were known. The first species to be described here has a conidial stage which Dr. Charles Thom has pronounced, after examination, to be a good *Scopulariopsis*. Without this conidial stage the fungus would be classed in the genus *Microascus*, or in one separated from it principally by the shape of the ascospores. We prefer to adopt this old genus name, *Microascus*, instead of one of the later names *Acaulium*, *Peristomium* or *Nephrospora*, and leave *Scopulariopsis* as the form genus under which the conidial stage can be described. The following is a formal description of the fungus as it grows in culture. Its usual substratum in nature is not known.

Microascus trigonosporus sp. nov.

Conidial form (**Scopulariopsis trigonospora** nom. nov.). Cultures on corn-meal agar sparse, gray becoming light-brown with the formation of conidia and finally dotted more or less closely

[1] A paper by M. Curzi on "Una nuova specie di Microascus" (Boll. R. Staz. Pat. Veg. **10**: 302–310. 1931) has just come to hand too late for comment in the text. The species he describes is very similar to our *M. trigonosporus*, but the two species are distinct.

with the black ascocarps. Mycelium composed of branching, septate hyphae 1.5–3 μ in diameter, homothallic. Conidiophores lacking, or simple and unbranched, bearing at the tip a chain of spores, or bearing at the tip a single verticil of sterigmata, or variously branched and bearing more or less distinct whorls of sterigmata. Sterigmata 5–7 μ long, usually inequilateral, with the diameter greatest near the middle where it becomes 2.5–3 μ, constricted at the base and tapering toward the apex. Conidia brown, oval to lemon-shaped, with a collar at the base, 2.7–3.2 × 4.3–5.5 μ, germinating from the side or rarely from the base. (PLATE 25, FIGS. 1, 2.)

Perithecial stage: Ascogonium coiled, antheridium not observed. Ascocarp globular with papillate ostiole, often with a pronounced beak, 125–235 μ in diameter on corn-meal agar, very early becoming black, the outer five to eight layers of cells heavily carbonized, the ascogenous hyphae growing downward from the ascogonium, which is then located well up under the ostiole. Asci oval, 7–9 × 8–11 μ on corn-meal agar, irregularly distributed and in general oriented toward the perpihery of the ascocarp and away from the ascogonium, eight-spored, deliquescing within the ascocarp. Ascospores triangular, but often thickened on one side so that some are almost four-cornered, 3–3.8 × 4.5–5.5 μ, discharged from the drying ascocarp as a long, light reddish-brown cirrhus 25–45 μ in diameter and reaching a length of 4 or 5 mm. (PLATE 25, FIGS. 3–6; PLATES 26, 27.)

Type locality, Porto Rico.

Type specimen deposited in the herbarium of The New York Botanical Garden.

The fungus was first isolated and grown on Sabouraud's maltose agar medium. On this medium it produces a luxuriant growth with an abundant gray aërial mycelium and numerous ascocarps. The colonies are restricted in extent and become wrinkled and raised above the surface of the agar. Within ten days or two weeks black ascocarps begin to develop in the aërial mycelium. As the culture grows older there is often a zone of ascocarps formed on the surface of the agar around the denser portion of the colony. These ascocarps may be quite closely

crowded together while there is scanty production of aërial hyphae in this region.

On corn-meal agar the growth is less luxurious and there is no buckling of the surface. The diameter of the colony may be greater than it is on maltose. The color of the young colony is gray but it becomes light-brown with conidial production. When cultures are kept at 37° C. the mycelium becomes dark-olive. Fewer ascocarps are produced than on maltose agar and the temperature range for ascocarp production is narrower, the optimum seeming to lie between 28° and 30° C. Gelatin is liquefied but there is no apparent odor of arsene.

The conidial stage of *M. trigonosporus* is typical of *Scopulariopsis*. The conidiophore is sometimes simple and unbranched, arising directly from the mycelium and bearing chains of conidia. This structure may be very short or even wanting, in which case the conidium is borne directly upon the mycelium. This sometimes occurs on submerged hyphae. In other cases the conidiophore is more richly branched and may bear more or less perfectly developed verticillate whorls of sterigmata (PLATE 25, FIG. 1). The sterigmata are swollen at the middle portion, constricted at the base, and taper toward the apex. They are often asymmetrical, being more swollen on one side than on the other. The chain of spores is enveloped by a thin membrane, most easily seen under oil in fresh mounts in sodium hydroxide solution. The conidia are uninucleate, smooth, oval to lemon-shaped, usually inequilateral, and with a thickened basal collar. Germination takes place from the side of the spore, usually from the side which is bulged and sometimes from both sides. In old spores germination is sometimes through the base, as it is reported to occur commonly in other species of *Scopulariopsis*.

Monospore cultures of the fungus show it to be homothallic. At least six cultures were secured from single conidia and twenty from single ascospores. All cultures produced both conidia and ascospores. The perithecia are highly carbonized and brittle and produce an audible sound when crushed under a cover slip. The outer wall of the perithecium is composed of from five to eight layers of carbonized, thick-walled, flattened cells. The inner wall is composed of four or five layers of larger thin-walled

cells, also flattened tangentially, and enclosing the sterile tissue and ascogenous hyphae.

Certain features in the development of the ascocarp are of considerable interest because of the information as to relationships which they may give. The ascocarp originates from a coiled ascogonium (PLATE 25, FIG. 3). In some cases hyphae which may have been antheridia were observed but in other cases such structures appeared to be absent. The ascogonium soon becomes enveloped by hyphae and the further development is shown by a study of sections. These show that the ascogonium is septate and the cells contain several nuclei (PLATE 26, FIGS. 1, 2). The young ascocarp at first is globular and then the ascogonium lies at its center. This relationship of its parts is maintained as the ascocarp increases in size by growth and cell division until it is 40–50 μ in diameter and the ascogonium is surrounded by about 8 or 10 cell layers. The cells in these layers are flattened tangentially and those of the outer layers are carbonized. The size of the young ascocarp is now increased by the elongation of these cells tangentially to the ascocarp. The space which such a type of growth would otherwise leave around the ascogonium is immediately filled by an inward growth of the cells which surround the ascogonium (PLATE 26, FIGS. 2–6). As space permits, they increase in length, until they become septate, slender, finger-like tapering hyphae growing inward from the inner perithecial wall. However those below the ascogonium develop much more rapidly and further than those beside or above it. As a result of this development the cell layers in a median section of the young ascocarp are concentric only toward the periphery. Inside these layers, which form the inner wall of the perithecium, there is a strong development of inward growing sterile hyphae from below, and a weaker development of inward growing hyphae from the sides and above. As a result of this differential growth the ascogonium comes to occupy a position above the center of the ascocarp instead of near the base as in most perithecia. At the same time, or a little later, there is evidence of ostiolar development. This is initiated by differential growth, which results, by tangential elongation of the inner perithecial cells, in an ostiolar cavity

schizogenetically formed (PLATE 27, FIGS. 2, 3). The elongation of these cells continues so that at maturity there is a papillate ostiole lined with short periphyses. In many cases a very pronounced beak forms (PLATE 27, FIG. 3).

Ascogenous hyphae have meanwhile grown out from the ascogonium and, because of the position of the latter up under the ostiole, most of this growth is downward although it occurs to some extent radially in all directions. These ascogenous hyphae branch freely but their radial orientation from the ascogonium remains at all times apparent. In this form croziers have not been observed. The asci appear to arise as side or terminal branches of the ascogenous hyphae. It may be possible that croziers sometimes occur, and in the closely related form to be discussed later structures which suggest them are sometimes present. The first asci form in the region near the location of the ascogone, that is, above the central cells of the ascocarp. The ripening of asci proceeds from this region peripherally, following the direction of growth of the ascogenous hyphae. The last asci to form are near the periphery toward the base of the ascocarp.

The orientation of the asci seems to depend entirely upon the direction of growth of the ascogenous hyphae and their mutual pressure. Consequently they are oriented in general toward the periphery of the ascocarp. This orientation is very definite in those which are at the extreme edge of the cavity next the perithecial wall. Although one is reminded of the peculiar position of the asci in catothecia and thyriothecia discussed by von Höhnel (**11**, **12**), the organization of the ascocarp here is wholly different and there is no reason to suppose that the groups he referred to are related to *Microascus*.

The asci are oval and are eight spored. They remain intact for a considerable period after the spores appear to be mature, but eventually they deliquesce. They no doubt contribute to the cementing substance which holds the spores in the cirrhus which is characteristic of this and related forms. The spores are yellowish-brown to fuliginous under the microscope. They appear to be triangular when examined. When rolled over in a liquid mount they are seen to be quite thick, and many are

sufficiently thickened at one point to form a fourth corner which is also visible upon focusing upward. The spore resembles in form and color that of *Bommerella trigonospora* as described by Marchal (**16**) but since the ascus of *B. trigonospora* is clavate and since, on other morphological grounds, that genus is presumably one of the Sordariaceae, the resemblance of the spores is no doubt only an accidental parallelism. *Bommerella* was separated from *Chaetomium* by its author largely on the basis of its triangular spores, but Chivers (**5**) includes it in *Chaetomium*. Students of the discomycetes usually consider species with spherical spores as generically different from those with elliptical spores. According to this line of reasoning it might seem that *Microascus trigonosporus* should not be included in the genus *Microascus*, the type of which, *M. longirostris*, has crescent-shaped spores. The evolution of either a triangular or a crescent-shaped spore from the kidney-shaped spore of *M. sordidus* would involve only a very slight further emphasis of the irregularity already initiated.

The spores of *M. trigonosporus* are set free within the ascocarp and as the culture dries (after two or three months at room temperature) the spores are slowly extruded as a cirrhus. This cirrhus development may require several weeks for completion and on the same agar slant one can find some ascocarps which still contain all their spores, some in which the spore mass is just beginning to emerge, and others in which spore discharge appears to be completed. The diameter of the cirrhus is from 25–45 μ and it may reach a length of at least 4 mm. Its color is reddish-brown. When sowed upon agar or in a moist chamber the spores germinate by sending out a germ tube from one or more corners (PLATE 25, FIG. 2). The spores at maturity are uninucleate, but since colonies arising from single spores produce ascocarps the species is homothallic.

Microascus trigonosporus is of considerable interest because of the peculiar organization of its ascocarp and the type of its conidial stage. These are such as to suggest that it may form a connecting link between divergent groups. The conidial fructification resembles in a general way that of *Penicillium*. Thom (**21**) points out that modern students of the groups do

not consider *Penicillium* and *Scopulariopsis* to be closely related. A superficial examination of ascocarps of *Microascus trigonosporus* and of similar ascocarps described by Sopp under the genus *Acaulium* and a comparison of these with the type of ascocarp found in some species of *Penicillium* support this view. However, when one comes to examine sections of mature ascocarps of the two types one finds that the arrangement of the ascogenous hyphae and distribution of the asci are similar. When, on the other hand, *Microascus trigonosporus* is compared with a member of the Sphaeriales such as *Sordaria* the external resemblance is seen to be strong, and in certain species of *Chaetomium*, especially, the asci tend toward the oval shape and deliquesce early. However, the internal arrangement of sterile and fertile tissue is quite different because of the peculiar position of the ascogonium and the ascogenous hyphae in *Microascus*.

Apparently most species of *Chaetomium* do not discharge their ascospores forcibly. The asci deliquesce early so that the spores lie free in the perithecial cavity from which they ooze out through the ostiole and tend to accumulate in the form of a tall heap. *C. trigonosporum* (*Bommerella trigonospora*) and *C. quadrangulatum*, Chivers says, are the only species having angular spores which he includes in the genus *Chaetomium*. It should also be noted that in these two species the spores are discharged in long narrow cirrhi. *Microascus variabilis* (**18**) develops a few hairs from the neck portion of the perithecium. *Chaetomium pusillum* and *C. chartarum*, both of which Chivers places in an allied genus *Ascotricha*, have conidial stages. The conidia are at first hyaline and then olivaceous-brown. We thus have a number of forms which on various morphological grounds show relationships. In species of *Aspergillus*, *Penicillium*, *Thielavia* and *Microascus*, the ascogenous hyphae grow out in all directions from the more or less centrally placed ascogonium. So far as known, the ascogenous elements of *Sordaria* and *Chaetomium* arise from the ascogonium placed well below in the perithecium, providing a fairly definite hymenial layer characterized by rather long asci.

The second species with which this paper deals is very much like *Microascus trigonosporus* in the origin and development of

the ascocarp. Although we have not succeeded in obtaining conidia, the fungus otherwise resembles in some particulars *Acaulium albo-nigrescens* (**20**). For reasons which have been stated the fungus is described below as a new species of *Microascus*.

Microascus intermedius sp. nov.

Perithecia black, pear-shaped, spherical or somewhat flattened, 75–150μ in diameter; ostiolar portion more or less papillate in mature fruit bodies; ascogenous hyphae growing outward and principally downward from an ascogonium usually placed somewhat above the center of the perithecium; asci oval to spherical, 7.5–10 × 10–11 μ, walls deliquescing early, leaving the spores free in the central cavity, eight-spored; individual ascospores very pale yellowish-brown, inequilateral or concave convex, 3.5–5.5 μ, discharged in long contorted coffee-brown cirri. (PLATE 28.)

On decaying strawberry roots.

Type locality, Chadbourn, N. C.

Type specimen culture deposited in the Herbarium of The New York Botanical Garden.

On ordinary corn-meal agar the mycelium is snow-white with very little aërial growth. It grows very slowly here as on all other media. Minute black specks, sclerotia, can just be made out with a hand lens. Olive-black, somewhat flattened perithecia begin to appear about the second week and become scattered rather thickly about the point of inoculation. The fungus was proved to be homothallic by the fact that single spore cultures always produce perithecia on this agar medium, either at room temperature or when incubated at 25–27° C.

On "Difco" corn-meal agar the mycelium is at first snow-white, but soon becomes dark-olivaceous or brownish, assuming a dendritic form of growth. Many little dark-colored sclerotia which can be seen without a lens are formed. Such cultures have been held at room temperatures, others have been incubated, but none has produced perithecia on this kind of agar. Transfers from these cultures to ordinary corn-meal agar begin to produce ascocarps within a few days.

On Difco potato-dextrose agar fascicles or tufts of aërial growth stand up from the surface. At first white, this growth becomes grayish to olivaceous and finally the culture turns

blackish because of the many perithecia formed in crust-like aggregations. On Difco dextrose agar the mycelium is white, the grayish-black appearance in older cultures being due to the presence of perithecia.

When ascocarps are formed on any medium discharge of ascospores may not begin until at the end of a month or even two months. They ooze from the ostiole and spread out about it in granular clumps. As the culture dries out the spores are discharged in cirrhi (PLATE 28, FIG. 4). Grown on different kinds of agar media, as well as on carrot, potato plugs and bread, no conidia have as yet been seen. Sopp (**20**) says of conidia of *Acaulium albo-nigrescens:* "In Kultur kann es selbst zu gewissen Jahreszeiten und auf einzelnen Nahrstoffen sogar immer schwer fallen, die Konidien zur Entwicklung zu bringen." Lechmere (**14**) says that the common form of *Peristomium desmosporum* did not produce conidia, but that a variety which he calls *P. desmosporum* var. *Verticillium* produced brown conidia which from his figures might be referred to *Scopulariopsis* notwithstanding their small size, 4 μ. He had a physiologic form of this variety which did not form conidia at ordinary temperatures, although it developed perithecia characteristic of *Peristomium*. At a higher temperature, 30° C., conidia just like those of the variety "*Verticillium*" were formed in abundance. Whether or not his type form without conidia is a *Microascus* and his variety *Verticillium* is a different species we have again another interesting parallel or correlation of forms.

Sopp's description of the origin and the growth of ascocarps of *Acaulium*, so far as he goes, corresponds very well with what Lechmere found for *Peristomium*, and their figures show a very clear relationship between their species. Whether Lechmere has given us the correct picture when he figures (**14**, 318, *fig. 9*) ascogenous hyphae growing out from the inner wall toward the center of the cavity is very doubtful. Unless one studies very young specimens he might confuse the upward inward growing rows of cells with ascogenous hyphae (see our PLATE 27, FIG. 3). There is no question that in both of our species the ascogenous hyphae beginning at the ascogonium well up under the ostiole grow out in all directions, downward and outward for the most

part, and directly back against the upward inward growing rows of sterile cells.

To assume that Sopp's technique was faulty and that the conidial stage he describes was that of a contaminant is not to be considered in light of his experience in culturing *Penicillia*. More likely, our fungus otherwise comparable to his species *Acaulium albo-nigrescens* is either a genotypically non-conidial race, or one which develops conidia only under very special conditions such as Lechmere found for his one physiologic form of *Peristomium*. The fact that our species does not develop ascocarps on Difco corn-meal agar but does so readily on ordinary corn-meal agar is proof of a very delicate balance as to nutritive conditions which might well dominate conidium production as well as perithecium formation.

In spore discharge the end of the cirrhus may bend down and become cemented to the spore mass about the ostiole, or to some other structure. By further discharge the cirrhus, often as much as 4 mm. long, becomes looped and entangled with other cirrhi, giving the culture the characteristic appearance noted by Lechmere for *Peristomium*. Cirrhi are not usually formed until a culture has dried out considerably. Sopp might therefore have easily overlooked such a type of spore discharge in his cultures of *Acaulium*. His figure 59 in plate 7 which he says shows "entleerte Sporenmassen" is clearly of a fragment of a cirrhus. He has given so many details as to cultural characters, and his measurements of perithecia, asci and spores correspond so well with ours, that we believe our fungus belongs to the same genus, but it is a distinct species and not a mere race or variety of his *Acaulium albo-nigrescens*. The method of the origin and development of the ascocarp in our species is the same as for *Microascus trigonosporus* and it is unnecessary to describe these details again.

Fraser and Chambers (**9**) state that the ascus of *Aspergillus herbariorum* sometimes arises from the binucleate cell of an ascogenous hypha whose uninucleate end cell turns back to complete the typical crosier. Dale (**6**) also found the same to be true for *A. repens*. Is it altogether logical to find asci of *Penicillium* borne in chains, as described by older authors, and

then find typical crosiers in *Aspergillus?* Can it be that the reasons usually held for throwing these two genera together in the same family are unsound morphologically? Relationships based on asexual stages, as noted previously, are not always confirmed by a study of the ascosporic fruiting structures. Material of neither species of *Microascus* studied by the writers is particularly suitable for a cytological study of the details of ascus formation. Very little evidence was found in the case of *M. trigonosporus* of the development of an ascus from the subterminal cell of a crosier. The tip ends of ascogenous hyphae of *M. intermedius*, however, were frequently seen bent somewhat in the form of a hook.

Rarely two or three ascogonia become involved in the organization of the same perithecium. In such cases two (or three) fertile regions, each independent of the other, result. Figure 3, plate 28, shows a section of a fruit body of this kind which happened to be cut so that only one group of ascogenous hyphae with the corresponding ostiolar portion appears in the section. At the lower left are seen the cut ends of the rows of sterile cells which are pointing toward a second set of ascogenous elements, visible several sections farther along in the series. Ordinarily there will be developed a distinct ostiole for each fertile region, but in the case shown here the second ostiolar structure for some reason was started on the wrong side of the perithecium and failed to mature. Undoubtedly here, as in other cases observed, the sterile tissue separating the fertile regions will disorganize so that all of the ascospores will be discharged through the same ostiole. Very well marked cases have been seen where three distinct and functional ostioles were formed by the same perithecium. A fruit body with two fertile regions and two ostioles which show in the same section are pictured in plate 28, figure 6.

The outer carbonized wall increases in circumference by elongation of its original elements and by intercalary growth, the lower portion growing more rapidly. With no corresponding growth of the central elements a schizogenous cavity would result. The thin-walled cells which surround the ascogonium in the early stages of perithecium development increase in size

up to a certain point, then as space is provided they elongate inwardly, becoming septate, tapering more and more as they approach the ascogonium, which, as noted previously, is now located above the center of the ascocarp or beneath the ostiole (PLATE 28, FIGS. 1, 2). Ascogenous hyphae and asci can develop only at the expense of this sterile tissue. The whole central cavity, then, which at the maturity of the perithecium is filled with asci and freed spores, is formed through disorganization of sterile tissue which at first grew in to fill the space provided by inequalities of growth. In principle the central cavity of a mature perithecium originates lysigenetically but only indirectly, because of the disorganization of cells developed more or less to fill a space being provided by forces working schizogenetically.

SUMMARY

The writers have studied in culture an ascomycete having a *Scopulariopsis* conidial stage and an ascocarp stage which corresponds to *Microascus*, except perhaps that it has triangular ascospores, whereas *Microascus sordidus* has kidney-shaped spores. This new species is described as *Microascus. trigonosporus*, and its conidial stage is referred to as *Scopulariopsis trigonospora*. The ascocarp arises from a coiled ascogonium which becomes enveloped in a hyphal weft of several layers of cells. Later this envelope becomes differentiated into an outer wall of dark-colored carbonized cells and an inner portion consisting of thin-walled colorless cells. The cells immediately surrounding the ascogonium begin to elongate inwardly, crowding in to fill up the space made available because of intercalary growth of the outer wall. A papillate ostiolar portion is then organized and its cavity formed schizogenetically. Because the outer wall increases in its circumference more rapidly below and at the sides than at the top, and because the inward growing hyphae develop more rapidly from below than from above, the ascogonium becomes placed well above the center and just beneath the ostiole. Most of the growth of the thin-walled cells is upward and inward. The ascogenous hyphae sometimes grow out from the ascogonium in all directions, but usually most of the growth, because of the position of the ascogonium, is outward

and downward, and, therefore, back against the upward inward growing rows of sterile cells. These sterile cells are gradually absorbed and their place in the cavity is taken by ascospores set free as the asci deliquesce. The ascospores are discharged in long slender cirrhi containing a cementing substance which hardens on drying and which then is dissolved in water only very slowly.

Microascus intermedius develops only ascocarps which in their organization, in general, correspond very well with *Microascus* of Zukal and, except for the absence of a conidial stage, it resembles Sopp's *Acaulium albo-nigrescens*. These two species, because of the *Scopulariopsis* conidial stage of one, and because of their black carbonaceous ascocarps with ostioles, and the growth of the ascogenous hyphae outward from the ascogonium in all directions, seem to make the series including *Penicillium*, *Aspergillus*, *Thielavia*, *Scopulariopsis*, *Microascus*, *Acaulium*, *Peristomium*, *Nephrospora* and *Chaetomium*, more complete.

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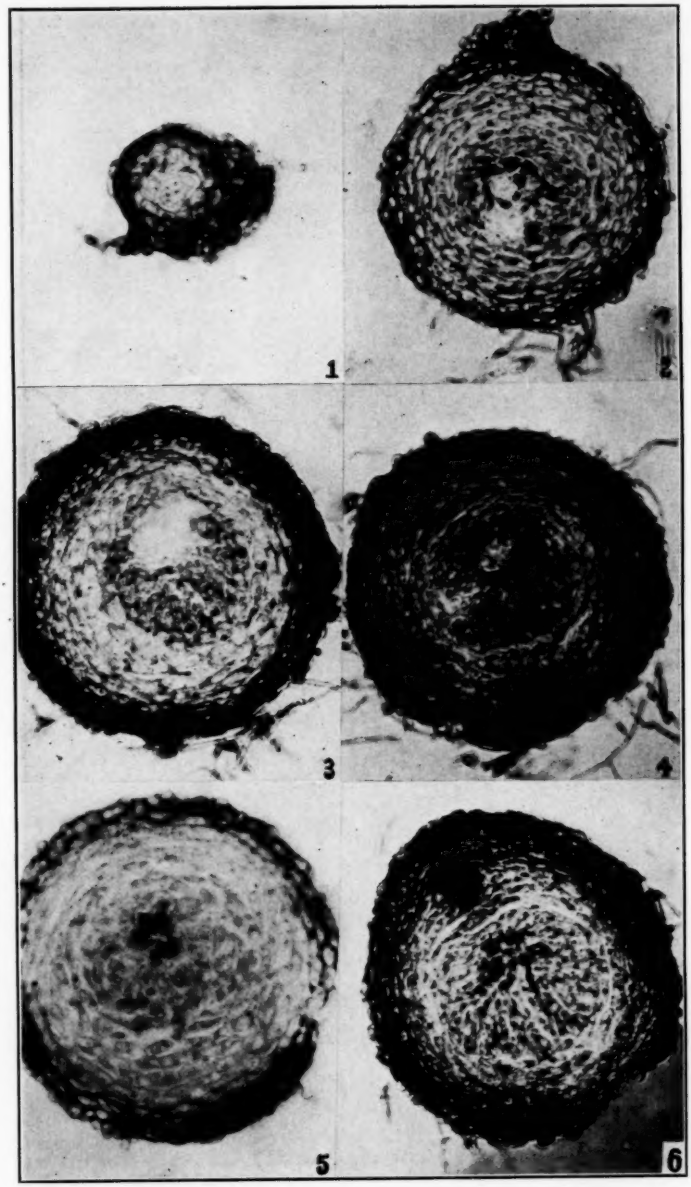
EXPLANATION OF PLATES

PLATE 25

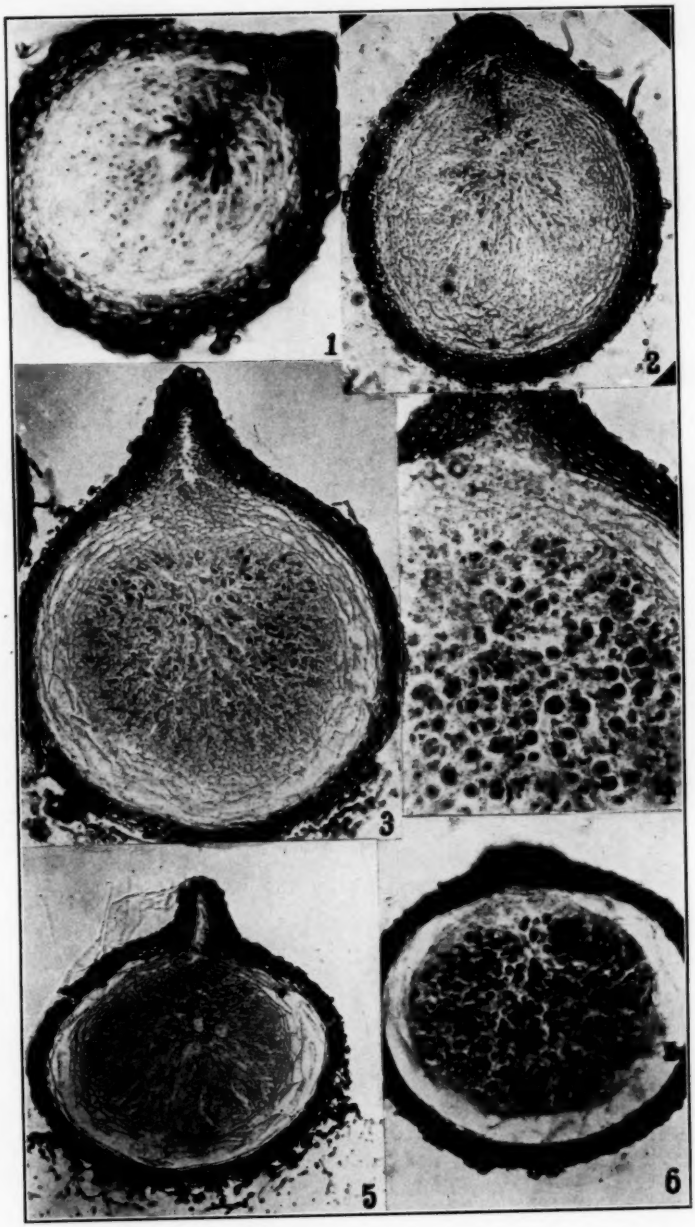
Microascus trigonosporus. Fig. 1. Conidiophores and conidia; 2. Conidiophores with partial whorls of sterigmata, conidia, and germinating conidia; 3. Stages in the formation of the ascocarp; 4. Ascogenous hyphae and young asci; 5. Ascogenous hyphae and young asci in some of which spores are partially formed; 6. Asci and spores; *a*, eight-spored asci; *b*, ascospores; *c*, germinating ascospore. Fig. 1, × 500; Figs. 2–6, × 1400.

PLATE 26

Microascus trigonosporus. Fig. 1. Young ascocarp showing two cells of the ascogonium, one cell of which, at this level, contains four nuclei; 2. Later stage in which multinucleate cells of the ascogonium are shown above a region where the cells are elongating inward. Median section; 3. Median longitudinal section of an ascocarp in which the upward growth of sterile tissue is more fully developed; 4. Median longitudinal section of an ascocarp in a



MICROASCUS TRIGONOSPORUS



MICROASCUS TRIGONOSPORUS

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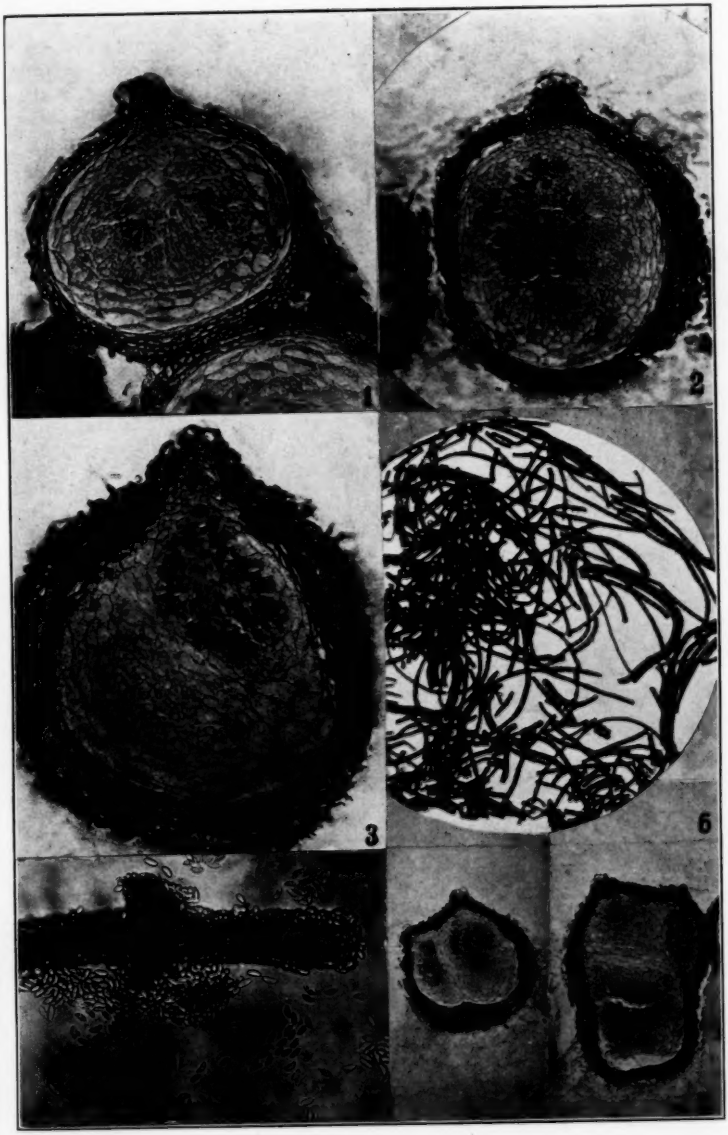

MICROASCUS INTERMEDIUS

stage similar to that of the one shown in Fig. 3; 5. Stage of development slightly later than that shown in figure 4. The ascogenous hyphae are just beginning to develop; 6. Ascogenous hyphae have begun to grow downward from the ascogonium, pushing against and in between the rows of sterile cells. The ostiolar development has begun. Fig. 1, × 675; Figs. 2–6, × 575.

PLATE 27

Microascus trigonosporus. Fig. 1. Median longitudinal section of an ascocarp showing downward growth of ascogenous hyphae. The developing ostiole is in the upper right corner. A part of the ascocarp has been cut away. × 675; 2. Median section of an ascocarp in which the ascogenous hyphae have grown far down into the sterile tissue. The ostiolar cavity is well developed. × 400; 3. The ascogenous hyphae have reached the perithecial wall at the base, a few asci already formed in the upper half of the ascocarp. The short periphyses are apparent in the neck of the ostiole. × 400; 4. Portion near the edge of an ascocarp showing asci. × 1200; 5. Ascogenous hyphae radiating from the ascogonium. × 350; 6. Section of a mature ascocarp filled with asci. The short neck of the ostiolar structure was not in focus. × 400.

PLATE 28

Microascus intermedius. Fig. 1. Section of a young ascocarp showing ostiolar structure and the ascogonium well above the center and just beneath the ostiole. Ascogenous hyphae growing out from the ascogonium and down against the sterile upward growing rows of cells. × 400; 2. Section of a somewhat older ascocarp, ascogenous hyphae growing out in all directions. × 400; 3. At the center above are shown deeply staining ascogenous hyphae growing out from the ascogonium just beneath the ostiole. Lower left, cut ends of rows of sterile cells such as are seen in longitudinal section in Fig. 1. Two ascogonia were involved in the origin of this ascocarp; the second set of fertile hyphae appeared several sections farther along in the series. × 450; 4. Ascocarp with two separate sets of ascogenous hyphae and two functional ostioles. × 200; 5. Two ostioles and three sets of ascogenous hyphae. × 200; 6. Fragments of cirrhi after soaking in water several hours. × 90; 7. Fragment of cirrhus and ascospores. × 600.

THE RUSTS OF SOUTH AMERICA BASED ON THE HOLWAY COLLECTIONS—IV[1]

H. S. Jackson

(With 6 Text Figures)

Species on Leguminosae—Mimosoideae

100. Diorchidium Piptadeniae Dietel, Hedwigia **38**: 252. 1899.

Puccinia papillifera Sydow, Monog. Ured. **1**: 836. 1904.
Diorchidium brasiliense Arth. Bull. Torrey Club **51**: 54. 1924.

Piptadenia latifolia Benth. Rio de Janeiro, Brazil, Aug. 9, 1921, *1009*.

Piptadenia laxa Benth. Petropolis, Rio de Janeiro, Brazil, Oct. 23, 1921, *1244;* Jacarépaguá, Rio de Janeiro, Brazil, Nov. 16, 1921, *1316;* Barbacena, Minas Geraes, Brazil, Dec. 12, 1921, *1385;* Nova Friburgo, Rio de Janeiro, Brazil, Jan. 1, 1922, *1437;* Garulhos, Brazil, June 1, 1922, *1929*.

We have assigned all the above collections to this species with some hesitation. Dietel described uredinia for the species. We find uredinia abundant on two of the collections (*1316* & *1929*) on *Piptadenia laxa*. Arthur described *D. brasiliense* from a portion of collection *1009* as a microcyclic species. We find urediniospores with the telia on duplicate specimens of this collection. The host of this collection was originally considered to be *Cassia* sp. It has since been identified as *Piptadenia*

[1] Joint contribution from the Department of Botany, Purdue University Agricultural Experiment Station, and the Department of Botany, University of Toronto. Prepared with the aid of a grant from the American Association for the Advancement of Science. This is the fourth of a series of papers bearing the same title. (See Mycologia **18**: 139–162. 1926; **19**: 51–65. 1927; **23**: 96–116. 1931.)

Drawings and photomicrographs in this and the preceding number in this series were prepared by Miss Lillian M. Hunter.

latifolia which is the host for Dietel's type. There exists on *Piptadenia*, *Puccinia Piptadeniae* P. Henn., which may be a *Diorchidium*. Hennings described uredinia for this species.

Arthur, as above noted, described his species as a microcyclic form with subcuticular pycnia. It would appear that there are two similar species of different life cycle, one a brachy-form and the other a micro-form, or it is possible that there is one mutable species. In assigning the collections to one species we have taken the latter view.

101. **Dichaerina superba** Jackson & Holway, sp. nov.

O. Pycnia amphigenous or caulicolous, few, inconspicuous among the telia or grouped in the centre of a group of telia, subcuticular, flattened hemispheric, 20–30 μ high by 90–150 μ broad, opening irregularly.

III. Telia amphigenous, caulicolous or petiolicolous, small, numerous, pulverulent, chestnut-brown, on hypertrophied areas 2–3 cm. long, when on stems or petioles; when on leaves occurring closely gregarious or confluent in circular or irregular groups 2–8 mm. across, often involving the veins and then spots more elongate; paraphyses few, occurring either at periphery or scattered throughout sorus, irregularly cylindrical, thin-walled, colorless; teliospores two-celled with vertical septum, 20–25 μ high by 22–28 μ broad, usually noticeably constricted between cells above, often less so below; wall uniformly thin 1–1½ μ, cinnamon-brown, adorned by conspicuous hyaline or tinted tubercles of irregular or elongate outline which occur abundantly scattered at apex of spore becoming less abundant below, often arranged in oblique lines with smooth areas between; pedicel short, deciduous, colorless, with two small cells at distal end on which are borne the two teliospore cells placed side by side.

Inga sp. Petropolis, Rio de Janeiro, Brazil, Oct. 20, 1921, *1234* type.

This is a conspicuous species occurring on all parts of the host, apparently becoming more or less locally systemic in the younger tissues and then causing considerable hypertrophy.

There would seem to be no doubt that this form is strictly microcyclic as pycnia occur consistently with the telia.

The type species of the genus, *Dichaerina binata* (Berk.) Arth., is described with uredinia. The pycnia are unknown but presumably subcuticular as in the species described above.

The two basal cells are easily overlooked in the mature spores, as they are usually collapsed. They are easily demonstrated in the young spores, however, and can often be detected in the mature ones. (FIG. 1.)

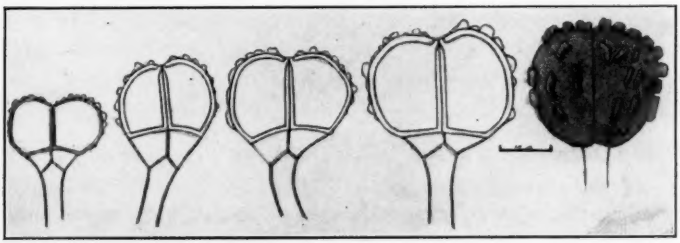

FIG. 1. Teliospores of *Dichaerina superba*. Those at the left are only partially developed. The two small basal cells are easily overlooked in fully mature spores.

102. RAVENELIA ECHINATA Lagerh. & Dietel; Dietel, Hedwigia **33**: 65. 1894.

Calliandra sp. Guayaquil, Ecuador, July 31, 1920, *804*.

The type of this species was collected in Ecuador, in 1891, by Lagerheim and does not appear to have been reported elsewhere.

103. RAVENELIA ECTYPA Arth. & Holway, Mycologia **10**: 120. 1918.

Calliandra laxa Benth. Sorata, Bolivia, Apr. 14, 1920, *520*.

This species has been previously reported only from Guatemala and Costa Rica. The single collection seems to agree well with the type. The species differs from *R. echinata* Lagerh. & Dietel primarily in the size and the number of cells in the teliospore-heads. The urediniospores are similar.

104. RAVENELIA HENNINGSIANA Dietel, Beih. Bot. Centr. **20**: 388. 1906.

Piptadenia sp. Rio de Janeiro, Brazil, Aug. 23, 1921, *1066;* Sept. 11, 1921, *1101*.

105. RAVENELIA HIERONYMI Speg. Anal. Soc. Ci. Argent. **12**: 66. 1881.

Aecidium Hieronymi Speg. Anal. Soc. Ci. Argent. **12**: 78. 1881.

Ravenelia Mimosae P. Henn. Hedwigia **34**: 95. 1895.

Ravenelia Acaciae-farnesianae P. Henn. Hedwigia **34**: 321. 1895.

Cystingophora Hieronymi Arth. N. Am. Fl. **7**: 131. 1907.

Acacia Farnesiana (L.) Willd. Banos de Cauquenes, Rancagua, Chile, Jan. 13, 1920, *295;* Papudo, Chile, Feb. 2, 1920, *313.*

A common species of wide distribution in South and Central America. The above listed collections consist of aecia only.

106. **Ravenelia idonea** Jackson & Holway, sp. nov.

O. Pycnia not seen.

II. Uredinia amphigenous, chiefly epiphyllous, subcuticular, scattered, round, small, cinnamon-brown, pulverulent, soon naked, ruptured epidermis conspicuous; paraphyses few, cylindrical or clavate, colorless, thin-walled, apex slightly thickened; urediniospores globoid, broadly or narrowly ellipsoid according to view, compressed laterally, 18–20 by 20–22 μ or 12–14 by 20–22 μ; wall cinnamon-brown, equal, thin, 1.5–2 μ, closely and prominently echinulate, pores 4, approximately equatorial.

III. Telia like the uredinia; teliospore heads compressed globoid, chestnut-brown, 45–75 μ in diameter, 25–30 μ high, composed of 10–22 cells with 5–7 central cells, smooth; cysts globoid, numerous, pendent from outer cells, not readily bursting in water; pedicel colorless, compound.

Acacia riparia H.B.K. Santa Anna, São Paulo, Brazil, May 25, 1922, *1879* (type).

Acacia sp. Nictheroy, Rio de Janeiro, Brazil, Aug. 18, 1921, *1055;* Rio de Janeiro, Brazil, Sept. 14, 1921, *1112.*

Mimosa sepiaria Benth. Rio de Janeiro, Brazil, Aug. 12, 1921, *1028.*

107. RAVENELIA INGAE (P. Henn.) Arth. N. Am. Fl. **7**: 132. 1907.

Uredo Ingae P. Henn. Hedwigia Beibl. **38**: 69. 1899.

Uredo excipulata Sydow, Ann. Myc. **2**: 350. 1904.
Uromyces ingicola P. Henn. Hedwigia **43**: 157. 1904.
Uromyces porcensis Mayor, Mém. Soc. Neuch. Sci. Nat. **5**: 459. 1913.
Haploravenelia Ingae Sydow, Ann. Myc. **19**: 165. 1921.

Inga edulis Mart. Rio de Janeiro, Brazil, Aug. 13, 1921, *1031*.
Inga insignis H.B.K. Valle Chiche, Quito, Ecuador, Sept. 3, 1920, *962*.
Inga sp. Petropolis, Rio de Janeiro, Brazil, Oct. 20, 1921, *1235;* Pinheiros, São Paulo, Brazil, March 27, 1922, *1684;* Alto da Serra, Brazil, June 14, 1922, *1968*.

According to the interpretation of Arthur (N. Am. Fl. **7**: 707, 1925) this species possesses two quite distinct types of uredinia. Collections *962*, *1684* and *1968* are primary uredinia with markings in more or less spiral striae while collections *1031* and *1235* are of the secondary type, which is often systemic in the stems and in which the uredospores are smaller and the wall echinulate. Culture work will be necessary to determine whether or not these two types belong to the same species. Telia are unknown for the species.

108. **Ravenelia irregularis** Jackson & Holway, sp. nov.

O. Pycnia not seen.

II. Uredinia epiphyllous, subepidermal, numerous, scattered, cinnamon-brown, pulverulent, ruptured epidermis noticeable; paraphyses not seen; urediniospores ellipsoid, obovate or pyriform, often irregular 10–12 by 18–26 μ, wall thin, 1–1.5 μ cinnamon-brown, slightly or not at all thickened at the apex, finely and moderately echinulate; pores 5 approximately equatorial.

III. Telia epiphyllous, subepidermal, scattered, chestnut-brown, soon naked, ruptured epidermis noticeable; teliospore heads chestnut-brown, made up of 10–22 cells, flattened globoid, 35–75 μ wide, 30 μ high, each cell with few, 4–8 hyaline or slightly tinted conical projections 2–3 μ high; cysts numerous, pendent.

Acacia sp. Rio de Janeiro, Brazil, Aug. 23, 1921, *1065;* Dec. 20, 1921, *1416* (type); Sylvestre, Rio de Janeiro, Brazil, Sept. 14, 1921, *1109*.

109. RAVENELIA LAGERHEIMIANA Dietel, Hedwigia **33**: 65. 1894.

Calliandra falcata Benth. Huigra, Prov. Chimborazo, Ecuador, Aug. 3, 1920, *822*.

The type collection of this species, which seems to be the only previous one, was made by Lagerheim in the same Province of Ecuador. The host is probably the same.

110. RAVENELIA LEUCAENAE-MICROPHYLLAE Dietel, Beih. Bot. Centr. **20**: 375. 1906.

Acacia sp. Gavea, Rio de Janeiro, Brazil, Sept. 8, 1921, *1100*.

The type locality for this species is in Mexico. The host was originally determined as *Leucaena microphylla* Benth., now identified as *Acacia angustissima* (Mill.) Kuntze. We have identified the collection as listed above because of the large urediniospores with 4 equatorial pores, the capitate paraphyses and large smooth teliospore heads.

111. RAVENELIA MIMOSAE-ALBIDAE Dietel, Beih. Bot. Centr. **20**: 378. 1906.

Mimosa albida H. & B. Chosica, Peru, July 22, 1920, *780*.

This species has apparently not been reported previously from South America. The type was collected in southern Mexico and only a few collections are known from that locality.

112. **Ravenelia rata** Jackson & Holway, sp. nov.

O. Pycnia amphigenous, chiefly epiphyllous, subcuticular, in small crowded groups, chestnut-brown, flattened hemispheric, 75–135 μ broad, 30–45 μ high.

III. Telia amphigenous, subepidermal in small groups among the pycnia, 1–2 mm. across, cinnamon-brown, soon naked, ruptured epidermis not conspicuous; teliospore heads cinnamon- to chestnut-brown, made up of 7–9 cells, irregularly flattened globoid, 30–45 μ wide, each cell with 8–10 hyaline, irregular tubercles 2–3 μ high; cysts 2–4 subgloboid, small and inconspicuous, evidently related to central cells of the head only; pedicel short, colorless, usually deciduous.

Acacia pedicellata Benth. Rio de Janeiro, Brazil, Aug. 13, 1921, *1032* (type); Sept. 14, 1921, *1110*.

This apparently distinct microcyclic form is without paraphyses. It would be placed in the genus *Dendroecia* of the Arthurian classification based on differences in life cycle. A feature noticed in connection with a study of sections seems worth recording. In the infected spots the upper epidermis is apparently raised above the palisade cells by the development of a weft of mycelium 10–15 μ thick. This weft extends slightly beyond the group of pycnia and telial sori. The leaf is therefore thickened not through hyperplasia but rather from the interpolation of a layer of tangled mycelium beneath the epidermis.

SPECIES ON LEGUMINOSAE—CAESALPINIOIDEAE

Mimema Jackson, gen. nov.

Pycnia and aecia unknown, the former probably subcuticular, the latter uredinoid. Uredinia and telia stilosporic. Teliospores three or more celled by the development of transverse septa. Somewhat parallel to *Hamaspora* but developing on Leguminosae.

113. **Mimema Holwayi** Jackson, sp. nov.

II. Uredinia hypophyllous, subepidermal, deep seated, scattered, small, .3–.5 mm. across, soon naked, whitish from the abundant paraphyses, becoming pulverulent, and cinnamon-brown from the urediniospores, ruptured epidermis not noticeable; paraphyses abundant, forming a dense fringe about the sorus, at first colorless becoming brownish due to deposit of color in contents, irregularly cylindric, 5–8 by 30–55 μ, pointed at tip, incurved, free or united to a compact tissue at base, wall colorless, thin, 1–1½ μ on inner side, irregularly thickened 2.5–5 μ on outer side, often solid at pointed tips; urediniospores ellipsoid or obovate 15–18 by 19–22 μ, wall 1.5–2 μ thick, finely and closely echinulate-verrucose, pores obscure, 4–6 in a super-equatorial zone.

III. Teliospores apparently following the urediniospores in the same sorus or one of similar type; cylindrical or fusiform, 8–10 by 75–105 μ long, composed of 3–5 cells, usually 4, the upper and lower cells usually longer than the middle ones, slightly constricted at the septa, rounded or obtuse above, tapering to

pedicel below; wall colorless, uniformly thin, 1 μ or less; pedicel colorless, 30–75 μ long, 8 μ broad above, tapering below.

Cassia versicolor Mey.? Villa Aspiazu, Sur Yungas, Bolivia, May 31, 1920, *690* (type); Hacienda "Anacuri," Nor Yungas, Bolivia, June 4, 1920, *715*.

This very interesting species is made the type of a new genus on grounds which we fully realize may not be acceptable to all uredinologists. In his recently revised generic classification of the Uredinales Dietel (in Engler, Die Natürlichen Pflanzenfamilien, Ed. 2, **6**: 24–98. 1928) has made use of the principle that the rusts have evolved with their hosts and that forms of similar morphology may appear independently in quite unrelated series. As an example one may take Dietel's treatment of the old genus *Triphragmium*. The species formerly included in this genus are now to be found in four genera in two tribes: *Triphragmium* in the Phragmidieae; *Triactella*, *Triphragmiopsis* and *Nyssopsora* in the Ravenelieae.

According to this treatment the Phragmidieae include a group of more or less closely related genera which occur on and have evolved with the members of the host family Rosaceae, while the Ravenelieae, on the other hand, have developed most abundantly, though not exclusively, on the Leguminosae. While in general the Phragmidieae have tended to the development of a series of genera characterized by transverse septa in the teliospores, the development in the Ravenelieae has centered primarily in the variations made possible by the development of longitudinal septa, culminating in *Ravenelia*. It would appear, however, that forms with transverse septa have developed in this series also.

This classification seems to the writer to approach more closely to a phylogenetic system than any that has previously been proposed and while such a system must be recognized as, in a sense, experimental, it seems worth while to give it a thorough trial. Many more forms remain to be discovered and it may be that when these are available for comparative study such a classification will prove unworkable. Dietel's classification, however, is likely to be adopted as the standard for some time to come, and it seems desirable in describing new forms to fit them into this

system. For these reasons the generic name *Mimema* has been provided for this species and others which may be later found to belong here.

We fully recognize that this genus parallels *Hamaspora* rather closely. *Hamaspora*, however, is known only on the genus

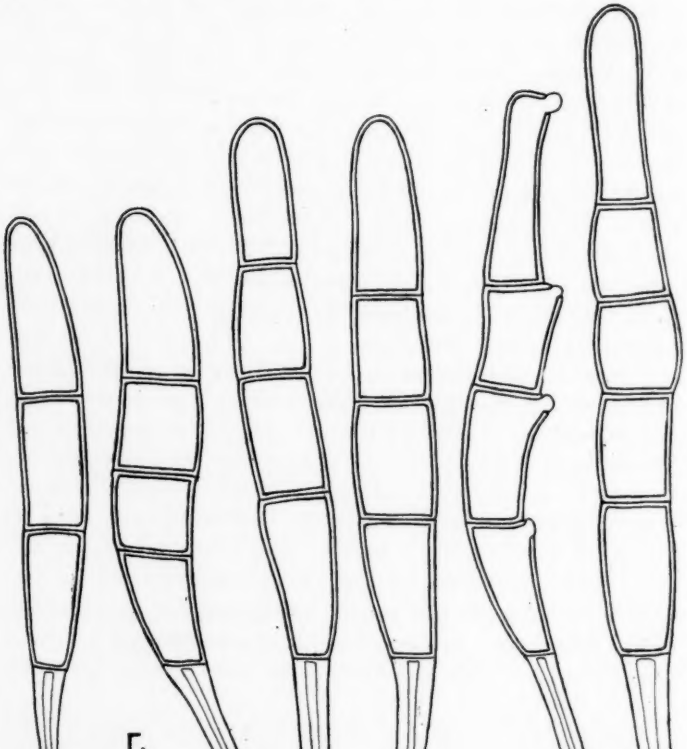

FIG. 2. Teliospores of *Mimema Holwayi*. Compare with figure 6.

Rubus of the Rosaceae and is included in the Phragmidieae by Dietel. A comparison of our species with several collections of *Hamaspora* leads to the conviction that the two rusts are not immediately related but that they have developed along parallel lines in unrelated series. We believe that *Mimema* should be included in the Ravenelieae for the present. For the benefit of those who believe that such an attempt at generic classification is premature and unwarranted, the name **Hamaspora Holwayi** comb. nov. might be used.

The teliospores (FIG. 2) apparently germinate at the apex and just below each septum, though no very evident pores are visible until germination has begun. The paraphyses form a dense fringe about the sorus. The latter in dried specimens appear white at first but become brown later apparently due primarily to the contents, though occasionally the wall may be tinted golden brown. The urediniospores are produced in great abundance and accumulate on the surface of the leaf.

114. **Triactella Holwayi** Jackson, sp. nov.

II. Uredinia hypophyllous, scattered, small, round, 0.2–0.4 mm. across, cinnamon brown, early naked, pulverulent, ruptured epidermis not conspicuous; paraphyses abundant, encircling the sorus, mostly arcuate, short, 25–38 μ long by 6.5–9 μ broad; the wall colorless or golden brown and somewhat irregularly thickened on both sides, often obliterating the lumen; urediniospores obovoid or broadly ellipsoid, 12–14 by 17–20 μ; wall colorless, 1–1.5 μ thick, very finely and closely echinulate, the pores 2–3 equatorial.

III. Telia like the uredinia, chestnut brown; paraphyses apparently as in the uredinia; teliospores three celled as in *Triphragmium*, nearly circular in outline when in face view, 24–26 μ by 25–26 μ, compressed and appearing considerably narrower when in side view; wall cinnamon brown, 2–2.5 μ thick, slightly thickened at angles, prominently echinulate-tuberculate with conical markings up to 6 μ high; pedicel colorless, short, ½ the length of the spore or less, attached at the center of the side wall of lower cell; pores obscure, apparently one in each cell.

Cassia sp. Tijuca, Rio de Janeiro, Brazil, Dec. 23, 1921, *1419*.

The genus *Triactella* Syd. is retained in the Ravenelieae of the recently revised classification of Dietel (l.c.) for those species of

Triphragmium having one germ pore in each cell, and which occur on Leguminosae. The type species for *Triactella* and the only one previously assigned to this genus is *T. pulchra* (Rac.) Sydow, which occurs in Java on *Derris elliptica*.

The teliospores in the species described above are characteristic (Fig. 3). Two celled teliospores occur fairly commonly, and rarely

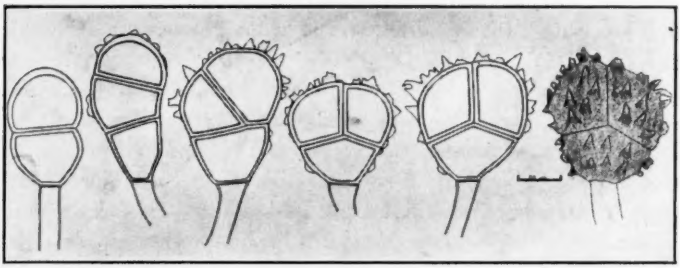

FIG. 3. Teliospores of *Triactella Holwayi* with variations. The three celled *Triphragmium*-like spores are typical.

the septum which separates the two upper cells is formed transversely. It is possible that *Uredo cassiicola* P. Henn. is the same, though paraphyses are not described. No specimens have, however, been available for comparison.

115. **Ravenelia faceta** Jackson & Holway, sp. nov.

O. Pycnia not seen.

II. Urediniospores in the telia ellipsoid or obovate, 26–30 by 18–21 μ, wall uniformly 1½–2 μ thick, chestnut-brown, very finely and closely verrucose, pores 4 equatorial.

III. Telia hypophyllous, subepidermal, scattered, minute, chestnut-brown, soon naked, ruptured epidermis evident; paraphyses numerous, scattered but chiefly peripheral, colorless; scattered paraphyses cylindrical or clavate, slightly thickened at apex; peripheral paraphyses incurved, somewhat irregularly cylindrical, thickened on the outer side; teliospore heads chestnut-brown 45–60 μ broad, composed of 8–12 cells, each bearing on outer wall numerous tinted appendages 3–6 μ high, lobed or tuberculate at apex; cysts colorless, few, 3–5, mostly 4, pendulous, small, globose, 15 μ in diameter, not readily bursting in water; pedicel colorless, compound, usually deciduous.

Cassia sp. Jacarépaguá, Rio de Janeiro, Brazil, Sept. 4, 1921, *1091*.

116. RAVENELIA MACROCARPA Sydow, Ann. Myc. **1**: 329. 1903.

Cassia bicapsularis L. Sylvestre, Rio de Janeiro, Brazil, Aug. 15, 1921, *1038*.

117. RAVENELIA MICROSPORA Dietel, Ann. Myc. **6**: 98. 1908.

Cassia excelsa Schrad. Petropolis, Rio de Janeiro, Brazil, Oct. 21, 1921, *1239;* Rio de Janeiro, Brazil, Dec. 20, 1921, *1415;* Pinheiros, São Paulo, Brazil, March 27, 1922, *1682;* São João, São Paulo, Brazil, July 2, 1922, *1990*.

A very distinct species separable from other species on *Cassia* by the minute urediniospores. It has been previously reported only from the type locality at Nossa, Lenhora, São Paulo, Brazil. The last collection listed above (*1990*) includes uredinia and telia, the others uredinia only.

118. ? UROMYCES DIETELIANUS Pazschke, Hedwigia **30**: 199, 1891.

Bauhinia sp. Petropolis, Rio de Janeiro, Brazil, Oct. 16. 1921, *1225*.

119. ? UROMYCES FOVEOLATUS Juel, Bih. Svernsk. Vet.-Akad. Handl. **23**: 16. 1897.

Bauhinia sp. Fonseca, Nictheroy, Rio de Janeiro, Brazil, Sept. 18, 1921, *1120;* Petropolis, Rio de Janeiro, Brazil, Nov. 3, 1921, *1270;* Mogy das Cruzes, Brazil, July 4, 1922, *1998*.

120. ? UROMYCES HEMMENDORFFII Vesterg. Arkiv. för Bot. **4**: 32. 1905.

Bauhinia sp. Rio de Janeiro, Aug. 12, 1921, *1025;* Mandaqui, São Paulo, Brazil, May 25, 1922, *1883*.

This species is distinguished by the small teliospores and the moderate thickening of the wall.

121. ? UROMYCES PERLEBIAE Vesterg. Arkiv. för Bot. **4**: 28. 1905.

Bauhinia forficata Link. São João, São Paulo, Brazil, March 19, 1922, *1652*.

Bauhinia forficata latifolia Benth. Prata, São Paulo, Brazil, Apr. 7, 1922, *1702*.

This species was originally described from Brazil and seems not to have been reported elsewhere. Specimen *1702* bears pycnia with primary uredinia showing that this species is a brachy-form. These are epiphyllous, pyriform or ellipsoid, deep-seated, 90–105 μ high by 90–100 μ broad, without ostiolar filaments.

122. **Uromyces verus** Jackson & Holway, sp. nov.

O. Pycnia epiphyllous, few, deeply seated, punctiform, closely grouped among telia, ellipsoid or pyriform 125–150 μ high by 100–135 μ wide, ostiolar filaments not noticeable.

III. Telia amphigenous or caulicolous, abundant, scattered or more commonly gregarious, often confluent on discolored spots, cinnamon-brown, soon naked, pulverulent, ruptured epidermis conspicuous particularly when epiphyllous, when caulicolous, extending for considerable areas along younger stems; teliospores ellipsoid or obovoid, 15–18 μ by 21–25 μ, rounded above and below; wall golden or light cinnamon-brown 2 or 3 μ thick, slightly thickened 4–6 μ at apex often with subhyaline umbo, closely uniformly and finely verrucose; pedicel colorless, short deciduous.

Bauhinia rufa Stend. Bello Horizonte, Minas Geraes, Brazil, Nov. 21, 1921, *1319* (type).

This micro-form with verrucose spores seems to be amply distinct. No other micro-form with this type of spore marking seems to have been described on *Bauhinia*.

SPECIES ON LEGUMINOSAE-PAPILIONATAE (FABACEAE)

123. AECIDIUM DESMODII P. Henn. Hedwigia **35**: 259. 1896.

Desmodium uncinatum Sw. Taipas, São Paulo, Brazil, Feb. 7, 1922, *1544;* Campo Grande, Rio de Janeiro, Brazil, Sept. 19, 1921, *1127*.

Desmodium sp. Sorata, Bolivia, Apr. 15, 1920, *526a;* Therezopolis, Rio de Janeiro, Brazil, Sept. 28, 1921, *1163;* Bello Horizonte, Minas Geraes, Brazil, Nov.

30, 1921, *1351;* Nova Friburgo, Rio de Janeiro, Brazil, Jan. 3, 1922, *1450;* Alto da Serra, São Paulo, Brazil, Jan. 28, 1922, *1505;* Cantareira, São Paulo, Brazil, Feb. 18, 1922, *1567a*.

This aecidium appears to be common especially in southern Brazil. While it has been commonly assumed to be the aecial stage of *Uromyces Hedysari-paniculati*, Holway repeatedly makes note that it is not followed by any other stage. He apparently believed it to be heteroecious. The aeciospores are smaller than usually described for the *Uromyces*.

Since there seems to be some doubt about the connection we have listed the aecidial collections separately from those of the *Uromyces*.

124. CHRYSOCELIS LUPINI Lagerh. & Dietel in Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 542. 1913.

Lupinus paniculatus Desv. Riobamba, Ecuador, Aug. 10, 1920, *861;* Quito, Ecuador, Aug. 18, 1920, *916;* Aug. 19, 1920, *921*.

Lupinus sp. along railway, foot of Cotapaxi, Ecuador, Aug. 12, 1920, *872;* Quito, Ecuador, Aug. 19, 1920, *919*.

This very interesting and characteristic species was originally described from Colombia. It was first collected in Ecuador by Lagerheim and is known otherwise only from Costa Rica. Arthur (N. Am. Fl. **7**: 663, 1924) places this genus in a special tribe Chrysoceliatae of the Uredinaceae (Melampsoraceae) while Dietel (Engler, Nat. Pflanzenfamilien, II. Auflage **6**: 48. 1928) places it in the tribe Oliveae of the Pucciniaceae. I would favour its inclusion in the latter family.

125. RAVENELIA PLATENSIS Speg. Anal. Mus. Nac. Buenos Aires **6**: 228. 1899.

Erythrina Crista-galli L. Petropolis, Rio de Janeiro, Brazil, Nov. 9, 1921, *1288*.

Erythrina sp. Therezopolis, Rio de Janeiro, Brazil, Sept. 28, 1921, *1157*.

This species appears to be known previously only from several collections made in Argentina and reported by Spegazzini. The collections listed above show primary uredinia only. These do not appear to have been previously distinguished. The sori occur on stems, petioles and leaves, often causing considerable hypertrophy and covering considerable areas. The pycnia are subcuticular, when on leaf blades amphigenous, flattened hemispheric, 40–60 μ high by 75–115 μ wide, often partially laterally confluent. The primary uredinia are amphigenous, irregular and confluent, often circinating about the pycnia. Paraphyses appear to be wanting. The urediniospores are broadly ellipsoid or obovoid, 25–28 by 30–35 μ, wall light chestnut brown, 3.5–5 μ thick, sparsely and very prominently echinulate, the pores three, approximately equatorial.

126. HAPLOPYXIS CROTALARIAE (Arth.) Sydow, Ann. Myc. **17**: 105. 1919.

Uropyxis Crotalariae Arth. Am. Jour. Bot. **5**: 429. 1918.

Crotalaria vitellina Ker. Sylvestre, Rio de Janeiro, Brazil, Sept. 16, 1921, *1114*.

This collection which consists of uredinia only seems to agree best with the above species. The rust has hitherto been reported only from Guatemala.

127. PHAKOPSORA CROTALARIAE (Dietel) Arth. Bull. Torrey Club **44**: 509. 1917.

Uredo Crotalariae Dietel, Hedwigia **38**: 256. 1899.

Crotalaria anagyroides H.B.K. Hacienda "Anacuri," Nor Yungas, Bolivia, June 5, 1920, *718*.

Known otherwise only from two collections made in Brazil.

128. **Phakopsora Psoraleae** Jackson & Holway, sp. nov.

II. Uredinia hypophyllous, deep seated, thickly scattered, small in section, 135–180 μ broad, 120–150 μ high, at first punctiform, pale, opening by a pore; paraphyses cylindrical, clavate or somewhat capitate, occurring scattered throughout the spore bearing surface, more numerous at sides and abundant at apex where they are incurved; wall colorless thin, becoming tinted

around opening, thickened to 6 μ or occasionally solid at apex; urediniospores short stipitate broadly ellipsoid, 15–20 μ by 24–30 μ, wall thin 1.5 μ, finely and closely verrucose, the pores obscure, apparently several in an equatorial zone.

III. Teliospores not seen.

Psoralea glandulosa L. Sorata, Bolivia, Apr. 14, 1920, *521* (type).

Psoralea lasiostachya Vog. Sorata, Bolivia, Apr. 22, 1920, *566*.

Though teliospores have not been seen we have little hesitation in assigning this *Uredo* to *Phakopsora*. The sori cover the leaves so uniformly as to suggest that the infection may possibly be systemic.

Allopuccinia Jackson, gen. nov.

Pycnia subcuticular, without ostiolar filaments. Aecia uredinioid, surrounded by numerous paraphyses, urediniospores stipitate, teliospores stipitate, two-celled with colorless, thin walls, germinating at once.

129. **Allopuccinia diluta** Jackson & Holway, sp. nov.

O. Pycnia epiphyllous or occasionally hypophyllous, small, punctiform, closely gregarious in small groups above or among the uredinia or telia; subcuticular, hemispheric or conical in section, 40–50 μ high, 60–90 μ broad, ostiolar filaments none.

II. Uredinia hypophyllous, small 0.2–0.5 mm. across, golden or cinnamon-brown, scattered or gregarious, soon naked, ruptured epidermis not noticeable; paraphyses abundant, conspicuous, chiefly peripheral, variable, irregularly cylindrical, clavate or arcuate-clavate, 40–65 μ long, 6–15 μ wide; wall colorless or golden-brown, thin 1–1½ μ except at apex in clavate forms, and on inner side of arcuate forms, irregularly thickened at apex or on one side 3–6 μ; urediniospores globoid or broadly ellipsoid 15–18 μ by 18–22 μ, finely and closely echinulate verrucose; wall thin 1½–2 μ, pores obscure.

III. Telia like the uredinia, occasionally larger 0.8–1 mm. in diameter, and lighter in color due to abundant germination of spores, paraphyses as in uredinia; teliospores cylindrical or narrowly ellipsoid, 14–18 μ by 40–60 μ, rounded to obtuse above, rounded or narrowed to pedicel below, slightly or not constricted at the septum; wall thin 1 μ or less, colorless, smooth, pores little differentiated, germinating at once from apex of

upper cell and at septum in lower cell; pedicel colorless, stout, equalling the spore or more commonly shorter.

Amicia lobbiana Benth. San Felipe, Prov. Sur Yungas, Bolivia, May 19, 1920, *611* (type); Sorata, Bolivia, Apr. 19, 1920, *549*.

This species is made the type of a proposed new genus intended to provide for those species which would ordinarily be included in *Puccinia* but which, because of subcuticular pycnia (FIG. 4)

FIG. 4. Pycnia of *Allopuccinia diluta*.

and occurrence on Leguminosae, show relation to the Ravenelieae. The reasons for erecting this genus are the same as given in the discussion under *Mimema Holwayi* (page 339).

The pycnia in the above species are clearly subcuticular (FIG. 4) and of very different type than is characteristic of *Puccinia*. The species appears to be closely related to *P. Bergii* Speg., which was originally described as on *Adesmia punctata*, but the host identification has recently been corrected by Spegazzini (Rev. Argent. Bot. **1**: 108. 1925), who now finds the host to be *Poiretia psoraloides*. This host genus is very closely related to *Amicia*. In the description of *P. Bergii*, however, no mention is made of paraphyses which form a very prominent character for the present species (FIG. 5).

The pycnia in this species appear to be associated with either uredinia or telia, or it may be that teliospores follow the urediniospores in the primary sorus.

Few species of *Puccinia* have been described on Leguminosae. *P. Piptadeniae* will probably prove to be a *Diorchidium*. In the

other species pycnia are unknown. Judging from the descriptions, however, it would seem entirely possible that the relation of these may prove to be with the above.

The teliospores germinate at once and have thin, colorless

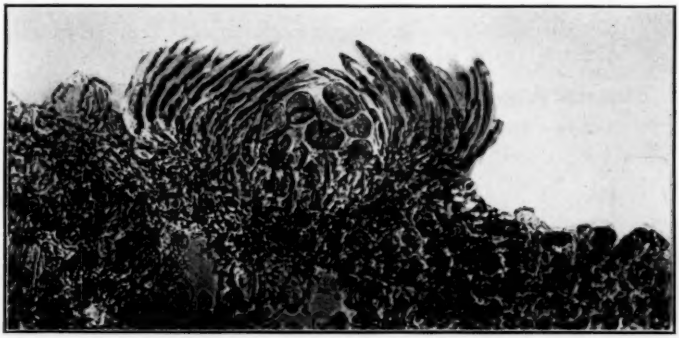

FIG. 5. Uredinial sorus showing paraphyses of *Allopuccinia diluta*.

walls (FIG. 6). There appear to be no evident germ pores visible previous to germination. A comparison of figure 6 with figure 2 is suggestive of the close relationship of this form with *Mimema Holwayi*. The uredinia of the two species are also similar in that both have prominent and abundant incurved paraphyses.

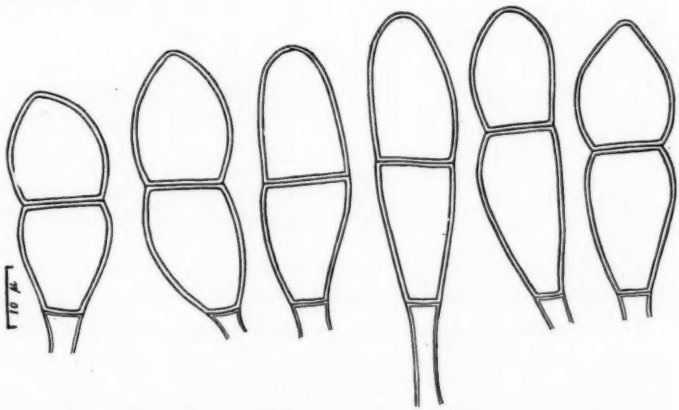

FIG. 6. Teliospores of *Allopuccinia diluta*. Note absence of pores. Compare with figure 2.

130. PUCCINIA OFFUSCATA Arth. Bull. Torrey Club **47**: 469. 1920.

Uredo Zorniae Dietel, Hedwigia **38**: 257. 1899 (Not *P. Zorniae* McAlpine. 1906).

Zornia diphylla (L.) Pers. Cochabamba, Bolivia, March 5, 1920, *370.*

This species suggests relationship with the preceding. Pycnia are unknown for the species and do not appear to be present in the above collection.

131. RAVENELIA INDIGOFERAE Tranz. Hedwigia **33**: 369. 1894.

Uredo Anilis P. Henn. Hedwigia Beibl. **38**: 68. 1899.
Pleoravenelia Indigoferae Long, Bot. Gaz. **35**: 129. 1903.

Indigofera suffruticosa Mill. Nictheroy, Rio de Janeiro, Brazil, Aug. 22, 1921, *1060;* Jacarépaguá, Rio de Janeiro, Brazil, Sept. 4, 1921, *1087;* Bello Horizonte, Minas Geraes, Brazil, Dec. 1, 1921, *1355.*

The collections listed above consist of uredinia only. The species is known in South America only from Brazil and Trinidad. It is also reported from Mexico, Guatemala, Cuba, Jamaica, and Bermuda.

132. RAVENELIA LONCHOCARPI Lagerh. & Dietel, Hedwigia **33**: 46. 1894.

Lonchocarpus sp. São João, São Paulo, Brazil, March 19, 1922, *1655;* Lapa, São Paulo, Brazil, June 4, 1922, *1941.*

Known in South America otherwise only from Minas Geraes, Brazil. It has, however, been reported also from Cuba and Salvador.

133. **Uredo emendata** Jackson & Holway, sp. nov.

II. Uredinia hypophyllous, scattered, round 0.2–0.3 mm. across, soon naked, pulverulent, chestnut-brown, ruptured epidermis not conspicuous; paraphyses numerous, clavate or cylindric 12–18 by 30–75 μ, only slightly incurved, wall thin colorless, slightly or not at all thickened at apex or on one side;

urediniospores globoid, 18–22 μ, wall chestnut-brown 2–2½ μ thick, very finely and closely verrucose-echinulate, the pores 4, approximately equatorial.

Meibomia Scorpiurus (Sw.) Kuntze. Guayaquil, Ecuador, Aug. 1, 1920, *805*.

134. **Uredo Eriosemae** Jackson & Holway, sp. nov.

II. Uredinia amphigenous, chiefly hypophyllous, minute, 0.2–0.3 mm. across, chestnut-brown, soon naked, pulverulent, ruptured epidermis conspicuous; paraphyses none; urediniospores globoid or broadly ellipsoid, 17–20 μ by 18–22 μ; wall chestnut-brown 2–2½ μ thick, finely and moderately echinulate; pores 3 or 4 approximately equatorial.

Eriosema crinitum (H.B.K.) DC. Santa Anna, São Paulo, Brazil, May 28, 1922, *1902*.

135. UREDO SOLITARIA Dietel & Neger in Engl. Bot. Jahrb. **27**: 16. 1899.

Adesmia elegans Clos. Panimavida, Chile, Dec. 20, 1919, *245*.

Adesmia laxa Clos. Termas de Chillan, Chile, Dec. 28, 1919, *252*.

Known otherwise only from the type collection made also in Chile.

136. UROMYCES APPENDICULATUS (Pers.) Link, Ges. Nat. Freunde Berlin Mag. **7**: 28. 1815.

Uredo appendiculata Pers. Ann. Bot. Usteri **15**: 16. 1795.

Uredo Pamparum Speg. Anal. Soc. Ci. Argent. **12**: 74. 1881.

Uredo rufa Speg. Anal. Soc. Ci. Argent. **17**: 124. 1884.

Phaseolus vestitus Hook. Chosica, Peru, July 23, 1920, *783 1/2*.

Phaseolus sp. Cochabamba, Bolivia, March 14, 1920, *411;* Sorata, Bolivia, Apr. 15, 1920, *526;* Nova Friburgo, Rio de Janeiro, Brazil, Jan. 7, 1922, *1465*.

The first listed collection has dark thick-walled urediniospores. Telia are not present and it is referred to the above species provisionally.

137. **Uromyces Bradburyae** Jackson & Holway, sp. nov.

II. Uredinia amphigenous, scattered or gregarious, small round 0.3–0.5 mm. across, light chestnut-brown, somewhat tardily naked, pulverulent, ruptured epidermis conspicuous; urediniospores oblong or ellipsoid, somewhat flattened laterally, 18–24 μ by 23–28 μ; wall cinnamon-brown or light chestnut-brown, 1½–2 μ thick, slightly thickened above and below, strongly and moderately echinulate, pores 2 equatorial.

III. Telia dark chestnut-brown, otherwise as in the uredinia; teliospores somewhat irregularly ellipsoid, ovoid, or obovoid, 16–24 μ by 27–36 μ; wall light chestnut-brown, 2–3 μ thick, apex with an abrupt paler umbo 5–7 μ thick, appearing smooth but obscurely and evenly verrucose; pedicel colorless, collapsing, equalling the spore or shorter.

Bradburya virginiana (L.) Kuntze. Campos do Jordão, Brazil, May 2, 1922, *1801.*

Bradburya pubescens (Benth.) Kuntze. Campos do Jordão, Brazil, April 20, 1922, *1735.*

138. UROMYCES CASTANEUS Sydow, Monog. Ured. **2**: 94. 1909.

Desmodium incanum Sw. Copacabana, Rio de Janeiro, Brazil, Sept. 21, 1921, *1136.*

Desmodium sp. San Francisco, Nictheroy, Rio de Janeiro, Brazil, Sept. 23, 1921, *1146.*

This distinct species is otherwise known only from the type collection on *D. incanum* made also at Rio de Janeiro, July 1887, by E. Ule (No. *664*). A portion of the type collection has been seen.

139. UROMYCES ELATUS Sydow, Ann. Myc. **6**: 482. 1908.

Lupinus paniculatus Desv. La Paz, Bolivia, March 18, 1920, *417;* May 14, 1920, *603;* Cuzco, Peru, June 29, 1920, *738.*

Lupinus soratensis Rusby. Sorata, Bolivia, Apr. 22, 1920, *561.*

Lupinus sp. La Paz, Bolivia, March 24, 1920, *454;* March 25, 1920, *459;* May 12, 1920, *595, 596.*

This -opsis form is easily distinguished by the conspicuous membranous peridium of the aecium and the long narrow colorless teliospores, germinating at once. The type collection

was made at La Paz, Bolivia, and has been previously reported from Peru by Arthur (Bot. Gaz. **65**: 466. 1918).

140. UROMYCES FABAE (Pers.) deBary, Ann. Sci. Nat. IV. **20**: 80. 1863.

Uredo Fabae Pers. Neues. Mag. Bot. **1**: 93. 1794.
Nigredo Fabae Arth. N. Am. Fl. **7**: 251. 1912.

Vicia Faba L. San Felipe, Chile, Sept. 25, 1919, *72;* Concepción, Chile, Oct. 25, 1919, *138;* La Paz, Bolivia, March 23, 1920, *443;* Huigra, Chimborazo, Ecuador, Aug. 4, 1920, *838*.

This species is evidently a common one in South America on this host, having been previously reported from Brazil, Argentina, Ecuador, and elsewhere. The rust is a cosmopolitan species.

141. UROMYCES FLECTENS Lagerh. Sv. Bot. Tidskr. **3**: 36. 1909.

Trifolium repens L. Valdivia, Chile, Nov. 13, 1919, *174;* Cochabamba, Bolivia, March 1, 1920, *353;* Quito, Ecuador, Aug. 13, 1920, *882;* Cuenca, Ecuador, Sept. 13, 1920, *984*.

All the collections from South America which we have seen include telia only, and appear to be microcyclic, though no pycnia have been observed. This is the form described by Lagerheim (l.c.). On *Trifolium repens* there is a series of forms of different life cycle but with similar morphology. The long cycle form, with all spore forms is either referred to *U. Trifolii* Lev. or to *U. Trifolii-repentis* (Cast.) Liro. The -opsis form is *Uromyces nerviphila* (Grognot). Transitional forms occur particularly in the -opsis form. One may find in the same collection groups consisting of pycnia and aecia or pycnia and telia.

142. UROMYCES HEDYSARI-PANICULATI (Schw.) Ellis, N. Am. Fungi *246*. 1878.

Puccinia Hedysari-paniculati Schw. Schr. Nat. Ges. Leipzig **1**: 74. 1822.
Uredo Desmodii-leiocarpi P. Henn. Hedwigia **41**: 107. 1902.
Uromyces Desmodii-leiocarpi P. Henn. Hedwigia **48**: 1. 1908.

Meibomia sp. Cochabamba, Bolivia, March 4, 1920, *364;* Hacienda Anacuri, Prov. Nor Yungas, Bolivia, June 4, 1920, *710;* Huigra, Chimborazo, Ecuador, Aug. 7, 1920, *857;* Rio de Janeiro, Brazil, Aug. 29, 1921, *1079;* Copacabana, Rio de Janeiro, Brazil, Sept. 21, 1921, *1135;* Alto da Serra, São Paulo, Brazil, Jan. 28, 1922, *1506;* Juquery, São Paulo, Brazil, Feb. 14, 1922, *1555;* Cantareira, São Paulo, Brazil, Feb. 18, 1922, *1566, 1567;* São Roque, São Paulo, Brazil, March 21, 1922, *1666;* Campos do Jordão, São Paulo, Brazil, Apr. 25, 1922, *1769.*

143. UROMYCES LATHYRINUS Speg. Anal. Soc. Ci. Argent. **12**: 71. 1881.

Aecidium lathyrinus Speg. Anal. Soc. Ci. Argent. **12**: 33. 1881.

Uromyces clavatus Diet. Hedwigia **36**: 27. 1897.

Uromyces Chilensis Dietel & Neger in Engler, Bot. Jahrb. **24**: 154. 1897.

Lathyrus magellanicus Lam. San José de Maipo, Chile, Oct. 8, 1919, *97;* Constitucion, Chile, Oct. 15, 1919, *118.*

144. UROMYCES MEDICAGINIS Pass. in Thüm. Herb. Myc. Oecon. *156.* 1874.

Uredo medicaginicola Speg. Anal. Mus. Nac. Buenos Aires **6**: 234. 1898.

Nigredo Medicaginis Arth. N. Am. Fl. **7**: 256. 1912.

Medicago Sativa L. Cordoba, Argentina, Aug. 11, 1922, *2021.*

This species, common in North America and Europe, has been reported from South America only from Argentina and southern Brazil.

145. UROMYCES NEUROCARPI Dietel, Hedwigia **34**: 292. 1895.

Uromyces rostratus P. Henn. Hedwigia **35**: 227. 1896.

Uromyces insularis Arth. Bull. Torrey Club **33**: 515. 1906.

Nigredo Neurocarpi Arth. N. Am. Fl. **7**: 258. 1912.

Clitoria brachystegia Benth. Portovelo, Prov. de Oro, Ecuador, Sept. 22, 1920, *1000*.

Clitoria cajanifolia Benth. Jacarépaguá, Rio de Janeiro, Brazil, Sept. 4, 1921, *1088;* Nov. 16, 1921, *1314;* Copacabana, Rio de Janeiro, Brazil, Sept. 21, 1921, *1138*.

A characteristic species, easily recognized by the thin-walled, elongated teliospores which germinate at once. *U. rostratus* P. Henn. was originally described as on *Eriosema*, an error for *Clitoria*, as pointed out by Dietel and Sydow. The species is reported from South America only from Brazil. It is also known from Trinidad, Porto Rico, Cuba, and Jamaica in the West Indies, and in Central America from Salvador.

146. UROMYCES ORBICULARIS Diet. Hedwigia **36**: 28. 1897.

Desmodium adscendens DC. Sorata, Bolivia, Apr. 12, 1920, *505*.

A very distinct -opsis form known previously only from the type collection made in Brazil. The aecia are hypophyllous, have prominent cylindrical peridia and the telia develop opposite them on the upper surface, evidently from the same mycelium.

147. UROMYCES TENUISTIPES Dietel & Holw.; Holway, Bot. Gaz. **24**: 25. 1897.

Desmodium uncinatum Jacq. Cochabamba, Bolivia, March 14, 1920, *408*.

Desmodium sp. Quito, Ecuador, Aug. 21, 1920, *931*.

This characteristic species is known otherwise only from Mexico.

148. UROMYCES TRIFOLII (Hedw. f.) Lév. Ann. Sci. Nat. III. **8**: 371. 1847.

Puccinia Trifolii Hedw. f. DC. Fl. Fr. **2**: 225. 1805.

Trifolium amabile H.B.K. La Paz, Bolivia, March 19, 1920, *426*, March 30, 1920, *485;* Sorata, Bolivia, Apr. 27, 1920, *577*.

Trifolium sp. Cochabamba, Bolivia, March 1, 1920, *352*.

Aecia are abundant in collections *485* and *577*. The rust resembles the long cycled form so common in North America on *Trifolium repens* L.

149. **Uromyces Trifolii-megalanthi** (Dietel & Neger) Jackson & Holway, comb. nov.

Aecidium Trifolii-megalanthi Dietel & Neger in Engler, Bot. Jahrb. **27**: 14. 1899.

Trifolium sp. Papudo, Chile, Sept. 18, 1919, *45;* Concepción, Chile, Oct. 29, 1919, *149*.

This species, originally described from Chile in the aecial form only, appears to be distinct. Both the collections listed above include telia. It is apparently related to *U. oblongus* Vize and to *U. elegans* (Berk.) Lag. The telia are small, round, pulverulent, somewhat tardily naked, blackish-brown. The teliospores are globoid or broadly ellipsoid, 18–22 μ by 20–24 μ, rounded above and below, wall evenly 2.5–3 μ thick with an inconspicuous hyaline papilla over the pore. The wall at first appears to be smooth but there are inconspicuous colorless markings sparsely placed along one to three longitudinal lines.

The species has more nearly the spore character of *U. oblongus* with the sorus character of *U. elegans*.

150. UROMYCES VIGNAE Barclay, Jour. Asiat. Soc. Bengal **60**: 211. 1891.

Vigna luteola (L.) Benth. Guayaquil, Ecuador, July 31, 1920, *803*.

This species, according to Fromme (Phytopathology **14**: 67–79, 1924) is distinguished from *U. appendiculata* primarily in the superequatorial position of the pores in the urediniospores.

151. **Uropyxis Amiciae** (Vesterg.) Jackson & Holway, comb. nov.

Puccinia Amiciae Vesterg. Micro. rar. Sel. *1363*, 1909 (nomen nudum).

II. Uredinia amphigenous, round, 0.3–0.8 mm. across, early naked, golden-brown, appearing compact due to abundant paraphyses, ruptured epidermis not conspicuous; paraphyses numerous, conspicuous, variable, chiefly periferous and arcuate-

clavate, 8–18 μ by 45–75 μ, wall colorless or tinted golden-brown, thin on the inside, thickened 4–6 μ on the outer side, often solidly thickened at apex; urediniospores globoid or broadly ellipsoid, 15–18 μ by 16–20 μ; wall colorless or tinted golden-brown, 3 μ thick, closely and prominently echinulate, pores numerous, scattered.

III. Telia like the uredinia, blackish-brown; teliospores ellipsoid, regular, 18–20 μ by 28–34 μ, inner wall 1½–2½ μ thick, chestnut-brown, outer wall colorless, 3 μ thick adorned by inconspicuous verrucose thickenings placed about 3 μ apart; pedicel colorless usually deciduous.

Amicia parvula Rusby. Cochabamba, Bolivia, March 7, 1920, *375*.

152. UROPYXIS DALEAE (Dietel & Holw.) Magn. Ber. Deuts. Bot. Ges. **17**: 115. 1899.

Puccinia Daleae Dietel & Holw. Bot. Gaz. **24**: 27. 1897.

Parosela pazensis Rusby. Cochabamba, Bolivia, Feb. 26, March 11, 1920, *333*, *401*.

This species has not been previously reported from South America. It is common in Mexico and reported from Guatemala and Salvador in Central America.

SPECIES ON GERANIACEAE

153. PUCCINIA CALLIQUENSIS Neger, Anal. Univ. Chile **93**: 777. 1896.

Geranium Berterianum Colla. Termas de Chillan, Chile, Dec. 31, 1919, *262*.

This species and the next following have a very similar habit. *P. calliquensis*, however, differs in the thickness of the teliospore wall which is much thinner, 2 μ or less, and in the markings which are uniformly finely verrucose. The species has evidently been reported previously only on the above host and only from the type locality also in Chile.

154. **Puccinia distenta** Jackson & Holway, sp. nov.

II. Uredinia hypophyllous, scattered or gregarious, round, 0.5–1 mm. across, dark, cinnamon-brown, somewhat tardily naked, pulverulent or plane, ruptured epidermis at first con-

spicuous later disappearing; urediniospores ellipsoid or obovoid, 22–26 μ by 28–30 μ; wall light cinnamon-brown 2–3 μ thick, evenly, minutely and rather sparsely echinulate, the pores 2 equatorial or approximately so, covered by a hyaline membrane which swells considerably in water.

III. Telia like the uredinia, blackish; teliospores more commonly found in the uredinia, ellipsoid or obovoid, rounded above and below, 26–32 μ by 38–46 μ, slightly or not at all constricted at septum; wall chestnut-brown, smooth, 3–5 μ thick, thickened to 9 μ at apex; pedicel short, colorless, deciduous.

Geranium Ochensii Phil. Viña del Mar, Chile, Sept. 10, 1919, *19* (type).

Geranium Core-Core Steud. Constitucion, Chile, Oct. 17, 1919, *123*.

Geranium sp. Sorata, Bolivia, Apr. 27, 1920, *576;* La Falda, Argentina, Aug. 14, 1922, *2027*.

The urediniospores of this species are similar to the preceding, but the teliospores differ markedly, in their lack of a conspicuous constriction at the septum and in the smooth walls. The species is evidently an eu- form as old aecia, too imperfect for adequate description, are present on one leaf.

155. PUCCINIA LEVEILLEI Mont. in C. Gay. Fl. Chil. **8**: 41. 1852.

Puccinia Geranii Lév. Ann. Sci. Nat. III. **5**: 270. 1846. Not *P. Geranii* Corda. 1840.

Puccinia Geranii-silvatici P. Karst. Not Sällsk. Faun. Fl. Fenn. **8**: 220. 1869.

Puccinia Leveilleana DeToni in Sacc. Syll. Fung. **7**: 696. 1888.

Micropuccinia Leveillei Arth. & Jackson; Arth. Bull. Torrey Club **48**: 41. 1921.

Geranium Berterianum Colla. Termas de Chillan, Chile, Dec. 31, 1919, *261*.

Geranium sp. Cochabamba, Bolivia, March 11, 1920, *400;* La Paz, Bolivia, March 24, 1920, *458*.

This characteristic micro-form was originally described from Chile and has apparently not been previously reported elsewhere in South America, unless *P. geraniicola* Speg. from Patagonia

should prove synonymous. The species is, however, not infrequent in western North America, also in Europe.

156. UREDO UNILATERALIS Arth. Bull. Torrey Club **45**: 155. 1918.

Geranium chilloënse Willd. Quito, Ecuador, Aug. 15, 1920, *895*.

Geranium sodiroanum Kunth. Quito, Ecuador, Aug. 15, 1920, *902*.

This characteristic species has not previously been reported from South America. It is otherwise known only from the type locality in Mexico. The spathulate-obovoid spores, flattened on one side and with a single germ pore on the flattened side serve to distinguish this species from all others on *Geranium*.

SPECIES ON OXALIDACEAE

157. PUCCINIA OXALIDIS (Lév.) Dietel & Ellis; Dietel, Hedwigia **34**: 291. 1895.

Uredo Oxalidis Lév. Ann. Sci. Nat. II. **16**: 240. 1841.

Aecidium mexicanum Maubl. Bull. Soc. Myc. Fr. **20**: 73. 1904. Not *A. mexicanum* Dietel & Holway. 1897.

Aecidium Maublancii Sydow, Monog. Ured. **2**: 351. 1904.

Oxalis scandens H.B.K. Sorata, Bolivia, Apr. 27, 1920, *580;* Quito, Ecuador, Aug. 31, 1920, *956*.

Oxalis sp. Sorata, Bolivia, Apr. 12, 1920, *509*, *510;* San Felipe, Prov. Sur Yungas, Bolivia, May 19, 1920, *614;* Quito, Ecuador, Aug. 28, 1920, *950;* Silvestre, Rio de Janeiro, Brazil, Sept. 16, 1921, *1118;* Guarulhos, São Paulo, Brazil, Jan. 30, 1922, *1514*.

This species is evidently a common one throughout South America and the West Indies. It is also known from Mexico and the southern United States. The rust is heteroecious with aecia on *Mahonia*. No collection of aecia has as yet been reported from South America.

SPECIES ON ERYTHROXYLACEAE

158. UREDO ERYTHROXYLONIS Graz. Bull. Soc. Myc. Fr. **7**: 152. 1891.

Erythroxylon Coca Lam. Hacienda Anacuri, Nor Yungas, Bolivia, June 3, 1920, *707*.

This is the only rust known on this host family in South America. The species was originally described from material collected in Bolivia and Peru. It has also been reported from Venezuela and Brazil and is known to occur in Cuba and Porto Rico. It apparently occurs wherever coca is cultivated.

SPECIES ON MALPIGHIACEAE

159. **Aecidium vinnulum** Jackson & Holway, sp. nov.

O. Pycnia epiphyllous, grouped in the center of spots opposite the aecia; punctiform, conspicuous, subcuticular or intraepidermal, applanate, or broadly conical, 160 × 215 μ in diameter, 60–100 μ high, ostiolar filaments converging, not conspicuous.

I. Aecia hypophyllous in groups on discolored spots 8–12 mm. across, numerous, cupulate, small; peridia white reflexed becoming fimbriate, peridial cells rhomboid in side view, considerably overlapping, 28–36 × 14–16 μ, outer wall smooth, 5–6 μ thick, inner wall finely verrucose, 3–5 μ thick; aeciospores somewhat angular, broadly ellipsoid, 16–18 × 20–24 μ, wall thin, 1 μ or less, finely and inconspicuously verrucose.

Byrsonima intermedia Juss. Guarulhos, São Paulo, Brazil, Jan. 30, 1922, *1511*.

This *Aecidium* appears to differ markedly from any previously described on this host and family. The pycnia are not subepidermal, but rather intraepidermal. The epidermal cells are quite large in this host species and the pycnia appear to develop at first between the cells, later digesting the upper portion, and finally are covered by the outer epidermal wall and the cuticle. The character of the pycnia suggests that this aecidium is connected with a rust belonging to the Melampsoraceae rather than the Pucciniaceae. Is it possible that this *Aecidium* is the aecial stage of *Crossopsora?* It will be noted that we have assigned tentatively two collections of *Uredo* to *Crossopsora notata* collected a few weeks later in the same region and on the same host.

160. CROSSOPSORA NOTATA Arth. N. Am. Fl. **7**: 695. 1925.

Uredo notata Arth. Mycologia **9**: 89. 1917.

Cronartium notatum Arth. Mem. Torrey Club **17**: 114. 1918.

Byrsonima crassifolia H.B.K. Hacienda Anacuri, Prov. Nor Yungas, Bolivia, June 4, 1920, II, III, *717*.

Byrsonima intermedia Juss. São Paulo, Brazil, Feb. 15, 1922, II, *1560;* Mandaqui, São Paulo, Brazil, May 25, 1922, II, *1886*.

So far as we are aware, this is the first record of this species in South America. It was described originally from Porto Rico and is also known to occur in Cuba.

161. PUCCINIA HETEROPTERIDIS Thüm. Myc. Univ. *839*, 1877.

Heteropteris sp. Villa Prudente, São Paulo, Brazil, May 31, 1922, *1926;* Guarulhos, São Paulo, Brazil, June 1, 1922, *1934;* Guapira, São Paulo, Brazil, June 11, 1922, *1957*.

An apparently distinct species, reported originally from Uruguay. It has been collected a number of times previously in Argentina and Brazil.

162. PUCCINIA INFLATA Arth. Bull. Torrey Club **33**: 516. 1906.

Bullaria inflata Arth. & Mains, N. Am. Fl. **7**: 486. 1922.

Stigmaphyllon sp. São João, São Paulo, Brazil, July 2, 1922, *1994*.

This collection was identified as above as it appears to fit that species admirably. It seems entirely probable, however, that this species is not distinct from the *Puccinia insueta* Wint. What appears to be needed before species limits can be satisfactorily established in this group of rusts is to have available an abundant series of specimens, the hosts for which have been accurately identified specifically. With the host situation as it is at present one obtains the impression that there is one very variable species, which may or may not be the true interpretation.

163. **Puccinia inrecta** Jackson & Holway, sp. nov.

II. Uredinia amphigenous, small, round, 0.3–0.5 mm. in diameter, cinnamon brown, early naked, pulverulent, ruptured

epidermis conspicuous; urediniospores ellipsoid or obovoid, 20–24 by 28–34 μ; wall cinnamon brown, 1.5–2.5 μ thick, sparsely, prominently and rather sharply echinulate; pores 4, approximately equatorial or more commonly scattered.

III. Telia like the uredinia, more commonly epiphyllous, blackish brown; teliospores somewhat irregularly ellipsoid, 25–29 by 32–38 μ, slightly constricted; wall chestnut brown, 2.5–3 μ thick, slightly thickened, 4.5 μ over pores, evenly and closely rugose-reticulate, the depressions often arranged in longitudinal lines; pedicel colorless, usually attached on one side of lower cell or near septum, apex swelling considerably in water, usually deciduous below the swelling.

Banisteria campestris Juss. Jardin d'Acclimacão, São Paulo, Brazil, Jan. 23, 1922, *1496;* April 15, 1922, *1734* (type).

This species appears to be quite different from *P. Banisteriae* P. Henn., which has the pedicel attached at the base and the wall markings described as verrucose. Our species may be the same as *Uredo banisteriicola* P. Henn. which is reported from the same region and answers our description quite well. Material has, however, not been available for comparison.

This species shows relationship to *P. insueta* and others, but seems to be amply distinct. The uredospores do not show the peculiar thickened walls of that species and the echinulate markings, while of the same type, are closer set and not so prominent.

164. PUCCINIA INSUETA Wint. Hedwigia **26**: 27. 1887.

Diorchidium insuetum Magnus, Ber. Deutsch. Bot. Ges. **9**: 192. 1891.

Stigmaphyllon acuminatum Juss. Nictheroy, Rio de Janeiro, Brazil, Aug. 18, 1921, *1051.*

Stigmaphyllon affine Juss. Juquery, São Paulo, Brazil, Feb. 2, 1922, *1529;* Hacienda, La Florida, Prov. Sur Yungas, Bolivia, May 27, 1920, *668.*

Stigmaphyllon tomentosum Juss. Cascadura, Rio de Janeiro, Brazil, Aug. 24, 1921, *1067.*

Stigmaphyllon vitifolium St. Hill. Nictheroy, Rio de Janeiro, Brazil, Aug. 18, 1921, *1050;* Nov. 15, 1921,

1305; Bom Successo, Rio de Janeiro, Sept. 13, 1921, *1108.*

Stigmaphyllon sp. Fonseca, Nictheroy, Rio de Janeiro, Brazil, Sept. 18, 1921, *1124;* Freguesia, Rio de Janeiro, Brazil, Nov. 18, 1921, *1317;* Friburgo, Rio de Janeiro, Brazil, Jan. 6, 1922, *1461;* Lapa, São Paulo, Brazil, June 4, 1922, *1939;* Petropolis, Rio de Janeiro, Brazil, Oct. 20, 1921, *1232*, Oct. 30, 1921, *1257;* Prata, São Paulo, Brazil, Apr. 7, 1922, *1703;* Silvestré, Rio de Janeiro, Brazil, Dec. 25, 1921, *1424.*

As here interpreted this is a variable species which on further study may include more than one closely related species. In general we have included those forms in which the outer wall of the urediniospore is colorless, swelling considerably and with prominent but remote echinulate markings. The teliospores are also variable in the different collections, both as to the character of the rugose markings and the size of the swelling at apex of the pedicel and the position of insertion of the latter.

The last four collections listed have smaller urediniospores and it is somewhat doubtful whether the host is *Stigmaphyllon.*

165. **Puccinia picturata** Jackson & Holway, sp. nov.

II. Uredinia amphigenous, chiefly hypophyllous, scattered, cinnamon brown, round, 0.5–0.8 mm. across, tardily naked, pulverulent, ruptured epidermis conspicuous; urediniospores broadly ellipsoid or obovoid approaching globoid, 32–40 × 35–45 μ; wall thick, 6–9 μ, often gradually thickened toward apex to 12 μ, appearing to be made up of two layers, the outer nearly colorless, the inner golden brown, strongly, sparsely and sharply echinulate, the markings placed 6–8 μ apart and reaching a height of 2.5 μ; pores obscure.

III. Telia like the uredinia, blackish; teliospores ellipsoid or oblong, 25–32 × 38–46 μ, rounded at either end, slightly or not at all constricted; wall opaque in water mount, appearing to be of two layers in lacto-phenol, the outer thin, slightly tinted golden brown, the inner thick, dull blackish brown, 3.5–5 μ thick, slightly thickened to 7.5 μ on side occupied by pores, noticeably rugose-reticulate by the anastomosing of ridges having an uneven edge, especially in the upper part of spore, tending to be smooth on the side to which the pedicel is attached; pedicel colorless, below, inflated to a depressed globoid sack 20–25 μ wide at point

of attachment which is usually on one side near the septum, the wall on the side of swelling next the spore often slightly tinted brownish, pedicel usually deciduous at lower side of inflation.

Heteropteris ? Juiz de Fora, Rio de Janeiro, Brazil, Dec. 17, 1921, *1401*.

An interesting species showing relation to *Puccinia insueta* Winter and *P. inflata* Arth., but apparently distinct. The urediniospores are larger and the teliospore color and markings appear very distinct in comparative study.

These species are difficult to describe, the inflated pedicel is attached at one side and the two cells of the spore are borne in a semihorizontal position. The pores, one in each cell, occur on the upper side of the spore in relation to the point of attachment of the pedicel. The thickness of the wall is greater around the pores and the markings are more prominent on the upper side.

SPECIES ON RUTACEAE

166. AECIDIUM RICKII Sydow, Monog. Ured. **4**: 201. 1923.

Xanthoxylum sp. Therezopolis, Rio de Janeiro, Brazil, Oct. 2, 1921, *1187*.

A very distinct species easily distinguished from the following by the larger size of the aeciospores with thickened apical walls. Otherwise known only from the type collection, also from Brazil (Thiessen, Dec. fung. Bras. *191*).

167. AECIDIUM XANTHOXYLINUM Speg. Rev. Argent. Hist. Nat. Buenos Aires **1**: 400. 1891.

Xanthoxylum sp. Friburgo, Rio de Janeiro, Brazil, Jan. 7, 1922, *1468*.

The type collection of this species was made in Paraguay. It has been doubtfully reported by Dietel from Brazil.

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CERCOSPORA STUDIES—II. SOME TROPICAL CERCOSPORAE [1]

W. G. Solheim and F. L. Stevens

(With 12 Text Figures)

This paper is the second in a series dealing with the genus *Cercospora*. In these studies the primary aims are to give adequate descriptions of the various species, to acquire definite concepts of individual species, and to assign the species to definite morphological groups within which comparisons may be made. No special effort is, therefore, being made at present to compare species. It is thought best to leave this until definite morphological groupings have been secured. Species are, therefore, reduced to synonomy only when the evidence is quite obvious.

In the first paper it was pointed out that conidia may germinate, producing conidiophores bearing secondary conidia. This has also been observed in several of the species herein described. In addition it has been observed that the conidia may produce secondary conidia without the production of conidiophores. When this is the case a secondary conidium is cut off from the tip of the conidium. Several more may be produced very near the tip. The primary conidium usually enlarges slightly at the tip and the secondary conidia are borne on short, dentate projections on the enlargement. This has been observed in *C. Cayaponiae* Stev. & Solh. and *C. Porophylli* Stev. & Moore.

It has been pointed out by various workers that certain fungi now recorded as *Cercospora* produce conidia catenulately. This character seems to be worthy of generic distinction. A new genus, *Ragnhildiana*, is, therefore, proposed (p. 402) to contain all such forms.

In the first paper the morphological characters suggested as a basis for sectioning the genus were outlined. Among these was the presence or absence of an external mycelium. It appears,

[1] The first paper of this series was published by W. G. Solheim in Ill. Biol. Mon. **12**: 1–84. 1929. (Issued March 7, 1930.)

after further study, that this factor can have little significance as a sectional character. Specimens of the same species have been seen with or without the external mycelium. The characteristic is of some value in species delimitation, however, as numerous cases occur in which there never is an external mycelium, while others always have it present.

Another character has been selected as having considerable value. This is the nature of the conidial scars, whether they are minute or indistinct or relatively large and distinct. The size of the scar appears to vary little no matter what the variation is in other characters. Using this character and eliminating the mycelial characteristic referred to above, the revised key to the sections is as follows:

KEY TO SECTIONS OF CERCOSPORA

I. Conidial scars indistinct, or, if distinct, then 2 μ or less in diameter.
  A. Conidiophores simple.
    1. Stroma tuberculate.
      a. Conidia acicular-obclavate..... Section I.
      b. Conidia abruptly obclavate..... Section II.
      c. Conidia cylindrical..... Section III.
    2. Stroma not tuberculate, composed of loosely to fairly compactly interwoven hyphae.
      a. Conidia acicular-obclavate..... Section IV.
      b. Conidia abruptly obclavate..... Section V.
      c. Conidia cylindrical..... Section VI.
  B. Conidiophores branched.
    1. Branching opposite..... Section VII.
    2. Branching alternate.
      a. Stroma tuberculate.
        1. Conidia acicular-obclavate..... Section VIII.
        2. Conidia abruptly obclavate..... Section IX.
        3. Conidia cylindrical..... Section X.
      b. Stroma not tuberculate, composed of loosely to fairly compactly interwoven hyphae.
        1. Conidia acicular-obclavate..... Section XI.
        2. Conidia abruptly obclavate..... Section XII.
        3. Conidia cylindrical..... Section XIII.
    3. Branching alternate and opposite.
      a. Stroma tuberculate.
        1. Conidia acicular-obclavate..... Section XIV.
        2. Conidia abruptly obclavate..... Section XV.
        3. Conidia cylindrical..... Section XVI.

b. Stroma not tuberculate, composed of loosely to fairly compactly interwoven hyphae.
1. Conidia acicular-obclavate..... Section XVII.
2. Conidia abruptly obclavate..... Section XVIII.
3. Conidia cylindrical..... Section XIX.

II. Conidial scars distinct, over 2 μ in diameter.
A. Conidiophores simple.
1. Stroma tuberculate.
a. Conidia acicular-obclavate..... Section XX.
b. Conidia abruptly obclavate..... Section XXI.
c. Conidia cylindrical..... Section XXII.
2. Stroma not tuberculate, composed of loosely to fairly compactly interwoven hyphae.
a. Conidia acicular-obclavate..... Section Eucercospora.[1]
b. Conidia abruptly obclavate..... Section XXIV.
c. Conidia cylindrical..... Section XXV.
B. Conidiophores branched.
1. Branching opposite..... Section XXVI.
2. Branching alternate.
a. Stroma tuberculate.
1. Conidia acicular-obclavate..... Section XXVII.
2. Conidia abruptly obclavate..... Section XXVIII.
3. Conidia cylindrical..... Section XXIX.
b. Stroma not tuberculate, composed of loosely to fairly compactly interwoven hyphae.
1. Conidia acicular-obclavate..... Section XXX.
2. Conidia abruptly obclavate..... Section XXXI.
3. Conidia cylindrical..... Section XXXII.
3. Branching alternate and opposite.
a. Stroma tuberculate.
1. Conidia acicular-obclavate..... Section XXXIII.
2. Conidia abruptly obclavate..... Section XXXIV.
3. Conidia cylindrical..... Section XXXV.
b. Stroma not tuberculate, composed of loosely to fairly compactly interwoven hyphae.
1. Conidia acicular-obclavate..... Section XXXVI.
2. Conidia abruptly obclavate..... Section XXXVII.
3. Conidia cylindrical..... Section XXXVIII.

SECTION I

Conidial scars minute or indistinct, conidiophores simple, stroma tuberculate, conidia acicular-obclavate.

[1] It is the intention to name all the sections eventually.

CERCOSPORA RACIBORSKII Sacc. & Sydow, Syll. Fung. **16**: 1070. 1902.

Type locality: Java.

Spots amphigenous, circular to somewhat angular, at times confluent, concentrically zoned, 1–15 mm., brown; border definite, raised, olivaceous to brown. Mycelium internal, subhyaline to olive-brown, 1.5–7 μ. Conidiophores amphigenous, solitary or loosely to moderately tufted, rupturing the epidermis, simple, straight, arising from a fairly compact to tuberculate stroma, olivaceous to brown with a reddish tinge, 35–140 $\times$ 4–5.5 μ, continuous or 1–4-septate; conidial scars mostly indistinct, laterally displaced, rarely shouldered. Conidia acicular, apex rounded, subhyaline to olivaceous, 35–140 $\times$ 2.5–3.5 $\times$ 2–2.5 μ, 3–20-septate.

On leaves of *Nicotiana* sp. and **Nicotiana Tabacum* L.

The specimen examined agrees well with the Saccardian description except that Saccardo records the conidia as being only 3–5-septate and 60–180 $\times$ 4–4.5 μ. This difference may or may not be of any significance.

The above species is very closely related to *C. Nicotianae* Ellis & Ev. from which it differs in producing a decidedly different type of spot and in having conidia with rounded apexes and being much more prominently septate.

Specimens examined: Herb. Univ. Ill., Hawaiian Fungi No. *925*, Kealakekua.

SECTION II

Conidial scars minute or indistinct, conidiophores simple, stroma tuberculate, conidia abruptly obclavate.

CERCOSPORA PERSONATA (Berk. & Curt.) Ellis & Ev. Jour. Myc. **1**: 63. 1885.—Sacc. Syll. Fung. **4**: 439. 1886.—Atkinson, Jour. Elisha Mitch. Soc. **8**: 43. 1891.—P. Henn. Hedwigia **43**: 395. 1904.—Heald & Wolf, Bur. Pl. Ind. Bull. 226: 49. 1912. *Pl. 3, fig. 9.*—Wolf, Ala. Exp. Sta. Bull. 180: 129–139. 1914. *Pl. 1; Pl. 3, fig. 2; Pl. 5, figs. 1–2.*—Kew Bull. 1920: 299.—Welles, Am. Jour. Bot. **12**: 202. 1925. *Pl. 18, figs. 45–46.*

* Starred names indicate hosts on which the fungus has been seen by the authors.

Syn. *Cladosporium personatum* Berk. & Curt. Grevillea **3**: 106. 1875.

Cercospora Arachidis P. Henn. Hedwigia **41**: 18. 1902. —Sacc. Syll. Fung. **18**: 600. 1906.

Type locality: Carolina.

Spots amphigenous, circular on leaf blade, 1–5 mm., oblong to elliptical on rachis and petiole, 1–2 × 4–6 mm., brown to blackish-brown, raised; border indefinite. Mycelium internal, possibly also external, subhyaline, 1–2.5 μ, stromatic mycelium brown, 2–5 μ. Conidiophores hypophyllous or occasionally also being produced above, very densely tufted, rupturing the epidermis or emerging through the stomata and rupturing the surrounding epidermis, erect, simple, somewhat geniculate above, tuberculate, brown with reddish tinge, 35–80 × 4–6.5 μ, continuous or 1–2-septate; conidial scars minute but distinct, aggregated towards tips, more or less laterally displaced and warty to shouldered. Conidia abruptly obclavate to cylindrical, pale-brown to olivaceous to yellowish-brown, 25–65 × 5–7.5 × 3.5–5 μ, 2–8-septate.

On leaf blades, rachis and petioles of **Arachis hypogaea* L. and on leaves of *Cassia occidentalis* L. and *C. corymbosa* Lam.

Welles reports conidiophores up to 154.8 μ and conidia up to 184 μ.

Wolf has reported this species as producing spermogonia. These have been observed in several of the specimens examined.

The specimen collected by F. M. Bailey in 1913, Herb. Univ. of Ill., ex Herb. Hort. Bot. Reg. Kew, from Queensland, Australia, is not *C. personata*. Beyond this the material did not permit determination of the fungus present.

Specimens examined: Herb. Univ. Ill. No. *32983*, ex Herb. U. S. Dept. Agric. No. *5032*, Starkville, Miss.; No. *20078*, ex Herb. S. M. Tracy, Starkville, Miss.; No. *5121*, J. A. Stevenson, Rio Piedras, Porto Rico; F. L. Stevens, Porto Rican Fungi Nos. *2447* and *2506*, Rio Piedras.—Ellis & Ev. N. Am. Fungi No. *2480*, Starkville, Miss.

SECTION III

Conidial scars minute or indistinct, conidiophores simple, stroma tuberculate, conidia cylindrical.

CERCOSPORA DEPAZEOIDES (Desm.) Sacc. Fungi Veneti **5**: 187; Fungi Ital. *Pl. 645;* Nuovo Gior. Bot. Ital. **8**: 187. 1876; Sacc. Syll. Fung. **4**: 469. 1886.—Frank, Krankh. Pfl. p. 602. 1880.—Ellis & Ev. Jour. Myc. **1**: 34. 1885.—Atkinson, Jour. Elisha Mitch. Soc. **8**: 61. 1891.—Malpighia **14**: 226. 1900.—Lindaw in Rabenh. Krypt.-Fl. **9**: 134. 1910.

Syn. *Exosporium depazeoides* Desm. Ann. Sci. Nat. III. **11**: 364. 1849.—Kickx, Fl. Crypt. Fl. II, 101.—Lamb. Fl. Myc. III, 198.

Passalora penicillata Cesati in Klotzsch, Herb. Myc. 2 ed. 587. 1857.

Vermicularia depazeoides Westend in Prodr. Fl. Bot. II, 4, p. 114. 1851.

Cercospora penicillata (Cesati) Fres. Beitr. **3**: 93. 1863.

Cercospora sambucina Ellis & Kellerm. Am. Nat. **17**: 1166. 1883.

Cercospora Sambuci Stev. & King, Ill. Biol. Mon. **11**: 59. 1927.

Type locality: France.

Spots amphigenous, circular to angular, solitary or confluent, more or less vein-limited, 1–5 mm., at first brown to reddish-brown, becoming silvery or ashen-gray; border definite, raised, brown, 100–300 μ, the whole at times surrounded by a reddish to purplish discolored zone. Mycelium internal, hyaline to olivaceous or yellowish-brown, 2–5 μ, stromatic mycelium yellowish-brown to olive-brown. Conidiophores amphigenous but more abundant above than below, densely tufted, rupturing the epidermis, sides irregular, suflexuous to flexuous, mostly simple but occasionally irregularly, alternately branched, arising from a compact to tuberculate stroma, brown, 30–155 × 3–5 μ, mostly continuous, at times 1–2-septate; conidial scars indistinct, laterally displaced. Conidia cylindrical, tapering slightly, straight or curved, dilute-olivaceous, 30–85 × 3–4.5 × 2.5–4 μ, 1–9-septate.

On leaves of **Sambucus* sp., **S. nigra* L., *S. nigra* L. var. *laciniata* Mill., *S. racemosa* L., *S. canadensis* L. and **S. mexicana* Presl.

C. ticinensis Cav. appears to be very closely related to this species and perhaps is only a variety of it.

Specimens examined: As *C. depazeoides* (Desm.) Sacc. Ellis & Ev. N. Am. Fungi *1749b*, Ames, Ia.—Seym. & Earle, Ec. Fungi *476*, Victoria Park, London, Canada. As *C. Sambuci* Stev. & King, Herb. Univ. Ill., Fungi of Costa Rica, No. *260* (type), Cartago.

CERCOSPORA MANIHOTIS P. Henn. Ann. Mus. Congo II. **2**: 104. 1907.—Sacc. Syll. Fung. **22**: 1421. 1913.—Welles, Am. Jour. Bot. **12**: 196–218, *pls. 12–20.* 1925.

Type locality: Kisantu Congo, Africa.

Spots amphigenous, circular to effuse, 1–3 cm., somewhat obscurely concentrically zoned above, dark-brown becoming yellowish-brown to ashen-brown above, olive-brown with a purplish tinge below, frequently appearing olive-brown due to abundance of conidiophores and conidia; border indefinite. Mycelium internal, hyaline to olivaceous, 2–5 μ, stromatic mycelium yellowish-brown to olive-brown. Conidiophores amphigenous but mostly hypophyllous, solitary to fairly compactly tufted, tufts effused over the spots, rupturing the epidermis or emerging through the stomata, straight, or somewhat geniculate above, arising from a fairly compact to tuberculate stroma, dilute-olivaceous, 25–80–110 $\times$ 3–5 μ, the longer ones frequently enlarged towards tips, up to 6.5 μ, continuous or 1–5-septate, simple or rarely with alternate branches arising near the bases; conidial scars distinct, minute, laterally displaced or somewhat shouldered. Conidia at first clavate, becoming cylindrical and tapering slightly, often curved, dilute-olivaceous, 25–70–90 $\times$ 4.5–6.5 $\times$ 4–6 μ, 2–9-septate.

On leaves of **Manihot utilissima* Pohl.

This species differs from *C. Henningsii* Allesch. in being amphigenous, mostly hypophyllous, and in having longer, septate, somewhat geniculate conidiophores and somewhat larger and more septate conidia. It differs from *C. Cassavae* Ellis & Ev. in producing much larger indefinitely bordered spots, in the effused tufts, and having cylindrical conidia. The conidia of *C. Cassavae* are mostly abruptly obclavate. The distinction between this species and *C. Cearae* Petch is not clear. The description of the latter species is too meager to warrant a definite comparison.

Specimens examined: Herb. Univ. Ill., Fungi of Panama No. *1085*, Gamboa; No. *1113*, Gamboa; No. *1230*, Juan Diaz; Fungi of Costa Rica No. *496*, Guapiles.

CERCOSPORA PURPUREA Cooke, Grevillea **7**: 34. 1878.—Ellis & Ev. Jour. Myc. **1**: 34. 1885.—Sacc. Syll. Fung. **4**: 464. 1886.

Syn. *Cercospora Perseae* Ellis & Martin, Am. Nat. **18**: 189. 1884.

Type locality: Georgia, Rav. Fungi Am. *190*.

Spots amphigenous, circular to irregular, more or less vein-limited, 0.5–2–6 mm., dark reddish-, purplish- to blackish-brown above, similar below but usually lighter or merely brown; border same as spot, surrounding leaf tissues yellowish to brown discolored. Mycelium internal and external: external mycelium on lower leaf surface, olivaceous, 1.5–3 μ; internal mycelium olivaceous to olive-brown, 1.5–5 μ. Conidiophores epiphyllous, densely tufted, rupturing the epidermis or effused on the external mycelium, subflexuous, arising from a tuberculate stroma, olive-brown, 20–95 $\times$ 3–4 μ, continuous or 1-septate, simple or very rarely branched; conidial scars indistinct, laterally displaced and somewhat denticulate or slightly shouldered. Conidia cylindrical, tapering slightly, dilute greenish-yellow, 20–100 $\times$ 2.5–3.5 $\times$ 2–3.5 μ, 2–9-septate.

On leaves of *Persea palustris* (Raf.) Sarg. and **P. gratissima* Gaertn.

The above description agrees well with the description recorded for the synonym *C. Perseae* Ellis & Mart. However, the description of *C. purpurea* Cooke is somewhat different, the conidiophores being recorded as 50–70 $\times$ 4–6 μ and the conidia 40–100 $\times$ 6–8 μ. The main difference in the descriptions lies in the diameters of the conidia and conidiophores. These differences are perhaps not of any consequence.

Specimens examined: Herb. Univ. Ill., Fungi of Panama No. *1191*, Frijoles.

CERCOSPORA HURAE Stev. Trans. Ill. Acad. Sci. **10**: 210. 1917.

Type locality: Mayaguez, Porto Rico, Herb. Univ. Ill., Porto Rican Fungi No. *478*.

Spots amphigenous, circular to angular, more or less vein-limited, 0.5–2 $\times$ 0.5–1 mm., brown, centers becoming grayish-

brown to gray above, numerous, concentric, raised lines marking the dead leaf tissues; border somewhat indefinite or definite, at times raised, brown to purplish. Mycelium internal, subhyaline to olivaceous, 2–5 μ, stromatic mycelium yellowish-brown. Condiophores amphigenous but more abundant below, moderately to densely tufted, emerging through the stomata or rupturing the epidermis, simple, subflexuous to flexuous, more or less geniculate, arising from a compact to tuberculate stroma, olivaceous, 15–95 × 3–4.5 μ, 1–2–3-septate; conidial scars minute, indistinct, laterally displaced or somewhat shouldered. Conidia cylindrical to fusiform to abruptly obclavate, straight or curved, dilute-olivaceous, 24–87 × 3–4.5 × 2.5–4 μ, 3–10-septate.

On leaves of **Hura crepitans* L.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *478* (type); No. *70*, Mayaguez; No. *3594*, Añasco.

CERCOSPORA BRADBURYAE Young, Mycologia **8**: 46. 1916.

Type locality: Rosario, Porto Rico, Herb. Univ. Ill., ex Herb. F. L. Stevens No. *446*.

Spots angular to irregular, at times somewhat circular, vein-limited, confluent, 1–2–6 mm., frequently involving large areas of the leaf, brown, yellowish-brown to tan, some of the vein-limited sectors frequently being quite dark; border indefinite. Mycelium internal and external: external mycelium olivaceous, emerging with the conidiophores or through the stomata, 1.5–3 μ; internal mycelium hyaline to olivaceous, stroma olivaceous, 2–4.5 μ. Conidiophores amphigenous, moderately to densely tufted, the denser tufts forming circular to elongate patches, rupturing the epidermis, emerging through the stomata, or effused on the external mycelium, simple or occasionally with alternate branches, walls smooth or irregular, arising from a tuberculate stroma, subhyaline to dilute-olivaceous, 11–55 × 3.2–4.5 μ, 1–2-septate; conidial scars minute, mostly indistinct, laterally displaced or slightly shouldered. Conidia cylindrical, or tapering slightly, straight or curved, acute at both ends, subhyaline to dilute-olivaceous, 25–115 × 1.6–3.2 × 1.6–2.5 μ, 3–13-septate.

On leaves of **Bradburya pubescens* (Benth.) Kuntze.

Specimens examined: Herb. Univ. Ill., ex Herb. F. L. Stevens No. *446* (type), Rosario; No. *6558*, Dos Bocas below Utuado; Nos. *3930*, *6296*, *479*, Mayaguez; No. *263a*, Santuree; No. *225a*,

Hormigueras; No. *6482*, Cabo Rojo; Nos. *5785*, *5796*, *5833*, San German; No. *446a*, Jayuya; No. *5609*, Luguillo Forest; No. *5412*, Guayama, all of Porto Rico; Fungi of Trinidad No. *826*, St. Augustine.

CERCOSPORA COSTI Stevens, Ill. Biol. Mon. **11**: 57. 1927.

Type locality: Gatun, Panama, Herb. Univ. Ill., Fungi of Panama No. *1343*.

Spots amphigenous, circular, angular to irregular, blanched, or ashen due to conidiophores, large, sometimes involving a whole leaf; border definite, raised, brown to tan. Mycelium internal and external: external mycelium subhyaline to straw-colored, 1.5–3 μ; internal mycelium subhyaline, yellowish or yellowish-

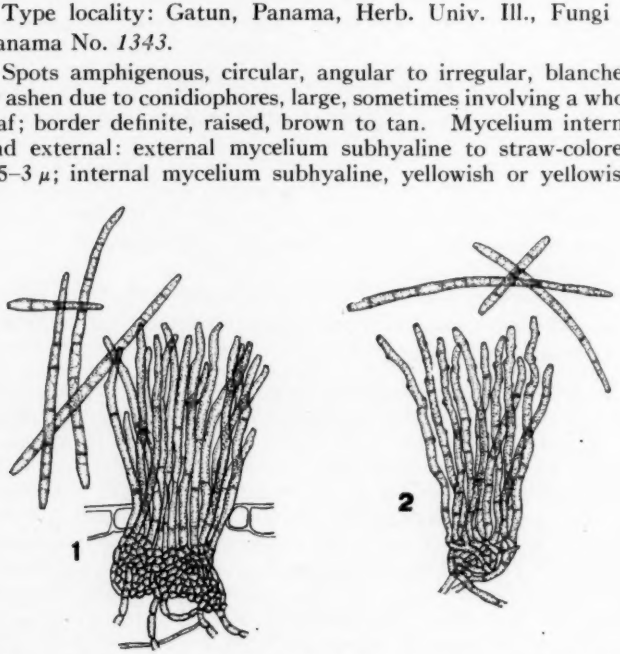


FIG. 1. *Cercospora guianensis*. Conidial scars indistinct, conidiophores simple, stroma tuberculate, conidia cylindrical.

FIG. 2. *Cercospora cylindrospora*. Conidial scars minute, more or less indistinct, conidiophores simple, loosely stromatic, conidia cylindrical.

brown, 2.5–5 μ, stroma brown. Conidiophores amphigenous, densely tufted, emerging through the stomata and rupturing the surrounding epidermis, simple, straight, wavy margined, arising from a large tuberculate stroma (up to 36 μ in diameter), straw-colored to yellow, 10–24 $\times$ 2–3 μ, 1–2-septate; conidial scars minute, indistinct, laterally displaced. Conidia cylindrical, bacilliform, curved, greenish-hyaline, 30–95 $\times$ 1.6–2.5 $\times$ 1.6–2 μ, obscurely several septate.

On leaves of *Costus* sp.

This species is readily distinguished from *C. costina* Syd.

Specimens examined: Herb. Univ. Ill., Fungi of Panama No. *1343* (type), Gatun.

Cercospora guianensis Stev. & Solh. sp. nov.

Type locality: Rockstone, British Guiana, Herb. Univ. Ill., Fungi of British Guiana No. *253*.

Spots amphigenous, subcircular to irregular, 2–8 mm., light rusty-brown above, light-brown below; border indefinite. Mycelium internal, hyaline to olive-brown, 1–3.5 μ. Conidiophores amphigenous, densely tufted, emerging through the stomata or rupturing the epidermis, simple, straight, arising from a compact to tuberculate stroma, olivaceous, 20–90 × 3–4 μ, 1–3-septate; conidial scars indistinct, laterally displaced. Conidia cylindrical to fusiform, or tapering slightly, straight or curved, dilute-olivaceous, 40–150 × 2.5–4 × 2–3.2 μ, obscurely 3–8-septate. [FIG. 1.]

On leaves of **Lantana* sp.

Specimens examined: Herb. Univ. Ill., Fungi of British Guiana No. *253* (type), Rockstone.

SECTION IV

Conidial scars minute or indistinct, conidiophores simple, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia acicular-obclavate.

CERCOSPORA BIXAE Allesch. & Noack, Bol. Inst. Agron. Estoda de São Paulo 9: **2**: 85. 1898.—Sacc. Syll. Fung. **16**: 1066. 1902.

Type locality: Campinas, Brazil.

Spots amphigenous, circular to angular, somewhat vein-limited, 1–7 mm., light-brown or tan, to grayish-brown above, light-brown below; border definite, not raised, reddish-brown to purple, 250–750 μ. Mycelium internal and external: external mycelium subhyaline to brownish, fine, 1.5–2.5 μ; internal mycelium subhyaline to brownish, 2–4 μ. Conidiophores amphigenous, emerging through the stomata, rupturing the epidermis or effused on the external mycelium, almost straight or flexuous, simple or occasionally with alternate branches, arising from a compact stroma, subhyaline to olivaceous, 15–52 × 2.5–3 μ, continuous or 1–3-septate; conidial scars minute, rather

indistinct, somewhat warty. Conidia acicular-obclavate, dilute-olivaceous to straw-colored, 25–130 × 3–4 × 1.5–2 μ, 3–10-septate.

On leaves of **Bixa orellana* L.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *56*, Mayaguez; No. *3795*, Rosario; No. *4845*, Lares.

SECTION VI

Conidial scars minute or indistinct, conidiophores simple, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia cylindrical.

Cercospora cylindrospora Stev. & Solh. sp. nov.

Type locality: Cabo Rojo, Porto Rico, Herb. Univ. Ill., No. *6482a*.

Spots amphigenous, circular to angular, more or less vein-limited and confluent, 0.5–2 mm., brown to grayish-brown; border definite, raised slightly, dark brown to reddish-brown. Mycelium internal and external: external mycelium subhyaline, 1.5–2 μ; internal mycelium, hyaline, yellowish to brownish, 2–4.5 μ. Conidiophores mostly hypophyllous, moderately to compactly tufted, emerging through the stomata or rupturing the epidermis, simple or very rarely branched, flexuous, arising from a fairly compact stroma, dilute-brownish to yellowish-brown, 30–105 × 2.5–3.5 μ, 1–7-septate; conidial scars minute, mostly indistinct, laterally displaced or at times somewhat shouldered. Conidia cylindrical, straight or curved, hyaline, 40–105 × 2–3.5 × 2–3.2 μ, 3–10-septate. [FIG. 2.]

On leaves of **Bradburya pubescens* (Benth.) Kuntze.

This species differs from *C. Bradburyae* Young, occurring on the same host, in producing a distinctly different type of spot and longer more septate, narrower conidiophores and more nearly cylindrical conidia.

Specimens examined: Herb. Univ. Ill. No. *6482a* (type), Cabo Rojo, Porto Rico.

Cercospora trinidadensis Stev. & Solh. sp. nov.

Type locality: St. Augustine, Trinidad, Herb. Univ. Ill., Fungi of Trinidad, No. *839*.

Spots amphigenous, angular, vein-limited, more or less confluent, 1–2 mm., brown to dark-brown; border indefinite or

definite, slightly raised, 0–300 μ, blackish-brown, surrounding leaf tissue yellowish discolored. Mycelium internal and external: external mycelium subhyaline, 1.5–2.5 μ; internal mycelium hyaline to olivaceous, 1.5–3.5 μ. Conidiophores hypophyllous, compactly tufted, rupturing the epidermis, simple, straight, stromatic, olivaceous to brown, 15–50 × 3–4 μ, continuous or 1-septate; conidial scars indistinct, laterally displaced. Conidia cylindrical, tapering slightly, olivaceous, 35–85 × 3.5–5.5 × 3.2–5 μ, 3–10-septate. [FIG. 3.]

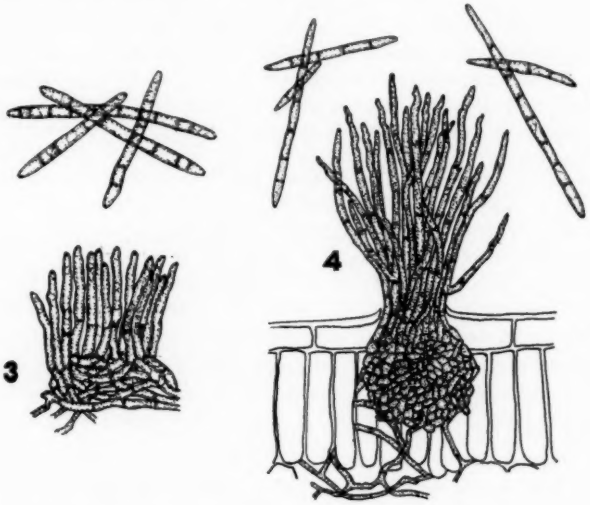


FIG. 3. *Cercospora trinidadensis*. Conidial scars indistinct, conidiophores simple, loosely stromatic, conidia cylindrical.

FIG. 4. *Cercospora Calapogonii*. Conidial scars indistinct, conidiophores alternately branched, stroma tuberculate, conidia cylindrical.

On leaves of **Croton gossypiifolius* Vahl.

Eight species of *Cercospora* have been recorded as occurring on various species of *Croton*. The above fungus appears to be distinct. However, it is possible that a comparison of types will put it in one of the described species.

Specimens examined: Herb. Univ. Ill. Fungi of Trinidad No. *839* (type), St. Augustine.

SECTION X

Conidial scars minute or indistinct, conidiophores with alternate branching, stroma tuberculate, conidia cylindrical.

CERCOSPORA ACHYRANTHIS Sydow, Ann. Myc. **7**: 171. 1909. —Sacc. Syll. Fung. **22**: 1429. 1913.—Stevens, Trans. Ill. Acad. Sci. **10**: 211. 1917.

Type locality: Ome, Musashi, Japan.

Spots amphigenous, angular, vein-limited, more or less confluent, rusty-brown to light-brown, 1–6 mm.; border indefinite. Mycelium internal, much branched, subhyaline to hyaline, very fine, 1.5–3.3 μ, stromatic mycelium brown, up to 5 μ. Conidiophores amphigenous, moderately to densely tufted, emerging through the stomata, straight to subflexuous, somewhat nodulose, arising from a fairly compact to tuberculate stroma, hyaline, subhyaline or subhyaline above and brownish toward bases, 15–130 $\times$ 3–4 μ, 1–3-septate, simple or not infrequently monopodially branched, the branches well developed and usually subtending a septum; conidial scars minute, fairly distinct or indistinct, laterally displaced or irregularly shouldered. Conidia cylindrical, tapering slightly, acute at bases, subhyaline, 25–80 $\times$ 3.3–5 $\times$ 2.5–4.7 μ, continuous or 1–5-septate.

On leaves of *Achyranthes bidentata* Blume, *A. bidentata* Blume var. *japonica* and **A. crispa* Desf.

The original description records conidiophores up to 220 $\times$ 4–6 μ and conidia to 125 $\times$ 3–6 μ and 5–10-septate. The shape and character of the spot also differs somewhat.

Specimens examined: Herb. Univ. of Ill., Porto Rican Fungi No. *333*, Guanica and No. *459a*, Hormigueras.

CERCOSPORA HIBISCI Tracy & Earle, Bull. Torrey Club **22**: 179. 1895.—Sacc. Syll. Fung. **14**: 1099. 1899.

Type locality: New Orleans, La.

Spots indefinite, the conidiophores forming sooty to olive-brown, more or less vein-limited patches on the lower surface of the leaf, the whole leaf surface frequently being involved, the leaf tissue eventually turning yellow to brown. Mycelium internal and external: external mycelium subhyaline, 1–2 μ; internal mycelium hyaline to olive-brown, 0.5–5 μ, stromatic mycelium blackish-brown. Conidiophores amphigenous but more abundant on the lower surface, compactly tufted, emerging

through the stomata, straight to subflexuous, more or less irregularly constricted, arising from a compact to tuberculate stroma, dilute-fuliginous, 25–140 × 3–5 μ, 1–6-septate, more or less branched, the branches alternate; conidial scars minute, indistinct, laterally displaced. Conidia cylindrical to obclavate, straight or curved, dilute-fuliginous, 25–90 × 3.5–5.5 × 3–5 μ, 1–7-septate, more or less constricted at septa.

On leaves of **Hibiscus esculentus* L.

This species was reported by Miss Young, Mycologia **8**: 44. 1916, as occurring on *Hibiscus tiliaceus* L. Her specimens were examined and all proved to be *C. hibiscina* Ellis & Ev. This species is quite distinct from the one described above.

Specimens examined: Herb. Univ. Ill., Fungi of British Guiana No. *175*, Tumatumari; Porto Rican Fungi No. *5030*, Quebradillas; No. *5229*, Aguadilla; No. *6465*, Cabo Rojo.—Seym. & Earle, Ec. Fungi No. *462*, Ocean Springs, Miss.

Cercospora Calopogonii Stev. & Solh. sp. nov.

Type locality: St. Augustine, Trinidad, Herb. Univ. Ill., Fungi of Trinidad No. *836*.

Spots amphigenous, subcircular to irregular, 3–7 mm., brown to dirty-brown; border indefinite or definite, darker than spot. Mycelium internal and external: external mycelium, subhyaline to olivaceous, emerging with the conidiophores above, through the stomata below, 1.5–3 μ; internal mycelium subhyaline, brown in stromata, 1.5–3.5 μ. Conidiophores mostly epiphyllous and then fairly densely tufted and coremioid, when below solitary or loosely tufted, lax and creeping, emerging through the stomata or rupturing the epidermis, straight to flexuous, arising from a compact to tuberculate stroma, olivaceous, 50–150 × 2.2–3.5 μ, 2–8-septate, more or less branched, the branches alternate and well developed; conidial scars minute, indistinct, laterally displaced or slightly shouldered. Conidia cylindrical to fusiform, at times somewhat curved, subhyaline to olivaceous, 25–90 × 2.5–3.5 × 2–3.5 μ, 2–7-septate. [FIG. 4.]

On leaves of **Calopogonium* sp.

Specimens examined: Herb. Univ. Ill., Fungi of Trinidad No. *836* (type), St. Augustine.

CERCOSPORA PANCRATII Ellis & Ev. Jour. Myc. **3**: 15. 1887.—Sacc. Syll. Fung. **10**: 654. 1892.—Tracy & Earle, Miss. Agric. Exp. Sta. Bull. **34**: 120. 1895.

Syn. *Cercospora Hymenocallidis* Pat. Bull. Soc. Myc. Fr. **28**: 142. 1912.

Type locality: Lousiana, Langlois No. *656*.

Spots amphigenous, circular to elliptical, more or less confluent, 2–14 mm., brown, blackish-brown, reddish-brown or red; border definite, raised, brown to blackish, fairly wide, or indefinite. Mycelium internal and external: external mycelium subhyaline, 1.5–3 μ, emerging with the conidiophores; internal mycelium subhyaline to olive-brown to brown, 1.6–4.5 μ, stroma black in mass. Conidiophores amphigenous, densely tufted, emerging through the stomata, or at times arising from the external mycelium, straight to flexuous, arising from a large tuberculate stroma, subhyaline to dilute-olivaceous becoming brownish, 25–110 $\times$ 2.5–3.5–4.5 μ, 1–3-septate, branched, the branches alternate, somewhat difficult to observe; conidial scars more or less indistinct, laterally displaced or somewhat shouldered. Conidia cylindrical-bacilliform, tapering slightly, subhyaline to greenish, 40–130 $\times$ 2–3.5 $\times$ 1.5–2.5 μ, 3–9-septate.

On leaves of **Hymenocallis* sp., *H. crassifolia* Herb., *H. littoralis* Salisb. and *Crinum americanum* L.

C. Hymenocallidis Pat. has not been seen but the description indicates that it is not distinct from *C. Pancratii* Ellis & Ev. It is, therefore, recorded as a synonym.

The specimens listed below were reported by Miss Young, Mycologia **8**: 44. 1916, as *C. Amaryllidis* Ellis & Ev.

Specimens examined: Herb. Univ. Ill., ex Herb. F. L. Stevens No. *244*, Santuree, Porto Rico and No. *836*, Caoma, Porto Rico.

CERCOSPORA BIFORMIS Peck, Bull. Torrey Club. **36**: 156. 1906.—Sacc. Syll. Fung. **22**: 1414. 1913.—Stev. Trans. Ill. Acad. Sci. **10**: 210. 1917.

Type locality: Batesville, Arkansas.

Spots amphigenous, irregular to angular, vein-limited, sometimes confluent, 3–5 mm., olivaceous, becoming dirty-brown; border indefinite. Mycelium internal and external: external mycelium dilute-brownish, 1.5–2.5 μ; internal mycelium irregular, subhyaline to dilute-olivaceous, 1.5–5 μ, stromatic mycelium dark reddish-brown as seen in mass. Conidiophores amphigenous, moderately to densely tufted, emerging through the stomata, rupturing the epidermis or effused on the external mycelium, flexuous, arising from a tuberculate stroma, olive-

brown to reddish-brown, 20–70 × 3–5 μ, continuous or 1–3-septate, more or less branched, the branches short and irregularly alternate; conidial scars minute, indistinct. Conidia cylindrical, subhyaline to dilute-brownish, 30–100 × 2.5–3.5 × 2.5–3 μ, 3–10-septate.

On leaves of *Passiflora incarnata* L. and **P. sexflora* A. Juss.

The specimen examined does not agree very well with the original description of the species. Peck records two types of conidia. Only cylindrical conidia were observed in the Porto Rican specimen. Three other species of *Cercospora* are recorded on *Passiflora* spp. None of the descriptions of these agree well with the fungus examined. From a comparison of the descriptions it is highly improbable that they are all distinct. Until further studies of these can be made the Porto Rican specimen is left as originally determined.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *1140*, Mayaguez.

SECTION XII

Conidial scars minute or indistinct, conidiophores with alternate branching, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia abruptly obclavate.

CERCOSPORA CASSAVAE Ellis & Ev. Bull. Torrey Club **22**: 438. 1895.—Sacc. Syll. Fung. **14**: 1104. 1899.—Young, Mycologia **8**: 44. 1916.

Type locality: Florida, G. V. Nash, Summer of 1895, No. *1950*.

Spots amphigenous, circular to angular, somewhat vein-limited, 2–8 mm., olive-brown to rusty-brown above, below at times with a bluish tinge due to bloom on leaf; border definite, raised, olive-brown to rusty-brown, 75–250 μ, a narrow strip of the surrounding tissue at times yellowish-green. Mycelium internal, regular to irregular, hyaline to olive-brown, 1.5–7.5 μ, stromatic mycelium yellowish-brown, to olive-brown, dark reddish-brown in mass. Conidiophores amphigenous, somewhat aggregated along the veins, solitary to fairly densely tufted below, densely tufted above, emerging through the stomata below, rupturing the epidermis above, straight, arising from a loose to compact almost tuberculate stroma, subhyaline, yellowish to olivaceous, 25–80 × 3–5 μ, continuous or 1–3-septate, mostly simple, but

not infrequently with branches arising at or near the bases; conidial scars minute, laterally displaced and somewhat dentate or at times somewhat shouldered, more or less indistinct. Conidia abruptly obclavate to cylindrical, dilute-yellowish to olivaceous, 20–65 × 4–6 × 3–5 μ, continuous or 1–6-septate.

On leaves of **Manihot* sp. and **M. utilissima* Pohl.

Three other species of *Cercospora* are recorded as growing on *Manihot*. These are *C. Henningsii* Allesch., *C. Manihotis* P. Henn. and *C. Cearae* Petch. The descriptions of these are too meager to judge whether or not they are distinct. From what description there is, it appears quite doubtful that they are so.

Specimens examined: Herb. Univ. Ill., Fungi of Costa Rica No. *821*, Port Limon; Porto Rican Fungi No. *254a*, Santuree; Fungi of Panama No. *1100*, Pedro Miguel.

SECTION XIII

Conidial scars minute or indistinct, conidiophores with alternate branching, stoma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia cylindrical.

CERCOSPORA HIBISCINA Ellis & Ev. Proc. Acad. Sci. Phila. **1895**: 438.—Sacc. Syll. Fung. **14**: 1099. 1899.

Type locality: Mexico.

Spots indefinite, the conidiophores forming sooty, velvety patches on the lower surface of the leaf and frequently covering the major portion of the leaf, the leaf tissue eventually becoming brown. Mycelium internal and external: external mycelium olivaceous, 2–3 μ; internal mycelium subhyaline, 1.5–3 μ. Conidiophores hypophyllous, loosely tufted, emerging through the stomata or effused on the external mycelium, straight, lax, somewhat geniculate towards tips and at times also for short distances at various points on the conidiophore, non-stromatic or loosely stromatic, dark-brown, 240–600 μ to 1 mm. × 3–4 μ, 9–25–35-septate, branched, the branches alternate and well developed; conidial scars minute, laterally displaced or somewhat shouldered. Conidia cylindrical or tapering slightly, subhyaline, olivaceous to reddish-brown, 20–70 × 3–4.5 × 3–4 μ, 2–6-mostly 3-septate.

On leaves of **Hibiscus tiliaceus* L.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *8073*, Dos Bocas; No. *310*, Las Marias; No. *8456*, Aibonito;

No. *8501*, Sigante; No. *8962*, Maricao; No. *9484* (locality not given); No. *9147*, Penuelas; Herb. Univ. Ill. ex Herb. F. L. Stevens No. *3630*, Rio Maricao above Maricao; No. *3793*, Rosario; No. *4797*, Maricao; No. *6564*, Dos Bocas; No. *6618*, Dos Bocas, all of Porto Rico.

CERCOSPORA PIPTURI Stev. & Glick, Bull. Bernice P. Bishop Mus. **19**: 155. 1925. *Fig. 33, b.*

Type locality: Kauai; Kalalau trail, Hawaii, Herb. Univ. Ill., Hawaiian Fungi No. *538*.

Spots indefinite, the conidiophores forming brown to sooty, velvety patches on the lower surface of the leaf and occasionally on the upper surface. Mycelium internal and external: external mycelium hyaline to brown, of two kinds, fine and regular or coarser and beaded, the latter type of mycelium occurring especially on the upper leaf surface, 1.5–5 μ; internal mycelium subhyaline, 1.5–3 μ. Conidiophores hypophyllous or occasionally also on the upper leaf surface (not necessarily above the lower spots), loosely tufted, emerging through the stomata or arising from the external mycelium, lax, intertwined with each other and with trichomes, non-stromatic, fuscus, at times with a reddish tinge, 100–550 $\times$ 3–6 μ, 10–25-septate, branched, the branches alternate, well developed; conidial scars mostly indistinct, laterally displaced or at times slightly shouldered. Conidia cylindrical, fusiform to obclavate, often curved, about the same color as the conidiophores or somewhat lighter to olivaceous, 40–115 $\times$ 4.5–8 $\times$ 4.5–6 μ, the greatest diameter usually obtaining near or just below the middle, 2–8-septate.

On leaves of **Pipturus gaudichaudianus* Wedd. (*P. albidus* A. Gray).

Specimens examined: Herb. Univ. Ill., Hawaiian Fungi No. *538* (type), Kalalau trail, Kauai; No. *766*, between Hilo and Kilauea, Hawaii; No. *894*, Kapapalo ranch, Hawaii; No. *1020*, between Kona and Waimea, Hawaii; No. *713*, Olympus, Oahu.

CERCOSPORA RIGOSPORA Atkinson, Jour. Elisha Mitch. Soc., **8**: 65. 1891.—Sacc. Syll. Fung. **10**: 635. 1892.—Underw. & Earle, Ala. Agric. Exp. Sta. Bull. **80**: 150. 1897.

Type locality: Auburn, Alabama.

Spots indefinite, the conidiophores forming olivaceous patches on the lower surface of the leaf and to a lesser extent on the

upper leaf surface, the infected leaf tissue eventually becoming yellowish to brown. Mycelium internal and external: external mycelium subhyaline, 1.5–3 μ; internal mycelium subhyaline to olive-yellow, 1.5–4.5 μ. Conidiophores amphigenous but mostly hypophyllous, moderately tufted, emerging through the stomata, flexuous, more or less torulose, non-stromatic, or arising from a small stroma, olivaceous, 20–110 × 3–5 μ, 1–7-septate, branched, the branches alternate, short or well developed; conidial scars minute, indistinct, laterally displaced or somewhat shouldered. Conidia cylindrical or tapering slightly, dilute-olivaceous, 15–82 × 2.5–3.5–(4.5) × 2–3 μ, 1–10-septate.

On leaves of **Solanum nigrum* L.

Specimens examined: Herb. Univ. Ill. No. *5316*, Rio Piedras, Porto Rico; Fungi of Costa Rica No. *6*, San Jose; No. *450*, Peralta.

CERCOSPORA CRUENTA Sacc. Michelia **2**: 149. 1880; Fungi Ital. *Pl. 686;* Fungi Carol. *Pl 2, fig. 8:* Syll. Fung. **4**: 435. 1886. —Ellis & Ev. Jour. Myc. **2**: 1. 1886.—Atkinson, Jour. Elisha Mitch. Soc. **8**: 56. 1891.—Jackson, Del. Agric. Sta. Bull. **83**: 22–24. 1908. *Figs. 11–12.*—Heald & Wolf, Bu. Pl. Ind. Bull. **226**: 49. 1912. *Pl. 1, fig. 2.*—Schwarze, N. J. Agric. Sta. Bull. **313**: 134, *fig. 801.* 1917.

Type locality: South Carolina.

Spots definite or indefinite, circular, subcircular, to irregular, more or less vein-limited and confluent, 1–10 mm., pale-green, yellowish, olive-brown, rusty-brown, to reddish-brown, appearing olivaceous below due to the conidiophores; border indefinite. Mycelium internal and at times external; external mycelium subhyaline, 1.5–2.5 μ; internal mycelium subhyaline to olivaceous, 2–5 μ. Conidiophores amphigenous, moderately to fairly compactly tufted, tufts scattered over almost entire leaf surface, emerging through the stomata or effused on the external mycelium, straight to subflexuous, non-stromatic or arising from a loose stroma, olivaceous, 20–65 × 3–4.5 μ, continuous or 1–3-septate, more or less branched, the branches alternate; conidial scars mostly minute, indistinct, laterally displaced and somewhat denticulate. Conidia cylindrical or tapering slightly, 35–140 × 3–4.5 × 2.5–4 μ, 1–13-septate.

On leaves, stems and pods of **Phaseolus* sp., **P. vulgaris*, L., *P. lunatus* L., *P. mungo* L., *Dolichos* sp. and **Vigna catjang* Walp.

The fungus which Welles has reported from the Philippine

Islands as *C. cruenta*, Phytopathology **14**: 351–358, *figs. 1–2* and Am. Jour. Bot. **12**: 208–218, does not appear to belong here. His drawings do not in the least resemble the species.

C. Dolichi Ellis & Ev. is perhaps identical with this species.

Specimens examined: Ellis & Ev. N. Am. Fungi *2294* (locality not given).—Seym. & Earle, Ec. Fungi *413*, Ocean Springs, Miss.; *514*, Auburn, Ala.—Herb. Univ. Ill., Fungi of British Guiana No. *18*, Georgetown.

SECTION XVII

Conidial scars minute or indistinct, conidiophores with alternate and opposite branching, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia acicular-obclavate.

CERCOSPORA BORRERIAE Ellis & Ev. Proc. Acad. Sci. Phila. **1894**: 379. 1894.—Tracy & Earle, Miss. Bull. **35**: 116. 1895. —Sacc. Syll. Fung. **11**: 627. 1895.

Type locality: Biloxi, Miss.

Spots? Mycelium internal, very irregular, olive-brown, appearing black in the stromata in mass, 2–7 μ. Conidiophores amphigenous, emerging through the stomata or rupturing the epidermis, straight or subflexuous, with more or less bulbose bases, arising from a loose to compact to almost tuberculate stroma, reddish-brown, 35–140 $\times$ 3–5 μ, continuous or 1–6-septate, more or less branched, the branches alternate and opposite, well developed; conidial scars laterally displaced and somewhat warty or shouldered becoming more or less indistinct. Conidia acicular-obclavate, subhyaline, 35–160 $\times$ 3–4 $\times$ 1–1.5 μ, somewhat obscurely 3–15-septate.

On leaves of **Borreria* sp. and *Spermacoce ocymoides* Burm (*Borreria micrantha*).

The material examined was such that it was impossible to determine the nature of the spot or whether an external mycelium was present.

Specimens examined: Herb. Univ. Ill., Fungi of Trinidad No. *858*, Port of Spain.

SECTION XIX

Conidial scars minute or indistinct, conidiophous with alternate and opposite branching, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia cylindrical.

Cercospora Cayaponiae Stev. & Solh. sp. nov.

Type locality: Rosario, Porto Rico, Herb. Univ. Ill., Porto Rican Fungi No. *3777*.

Spots indefinite, the conidiophores forming sooty to reddish-brown, vein-limited patches on the lower surface of the leaf, the infected leaf tissue eventually becoming yellowish to brownish discolored. Mycelium internal and external: external mycelium abundant, emerging through the stomata, hyaline to brown, 1.5–3.5 μ; internal mycelium subhyaline, fine, 1–2.5 μ. Conidiophores amphigenous, mostly hypophyllous, moderately to fairly densely tufted, emerging through the stomata, flexous, more or less geniculate, non-stromatic, reddish-brown, 30–175 $\times$ 3.5–5.5 μ, 1–5-septate towards bases, much branched, the branches both alternate and opposite but mostly alternate; conidial scars minute but distinct, laterally displaced or shouldered. Conidia cylindrical, dilute-yellowish to yellowish-brown, 25–110 $\times$ 4–5 $\times$ 3.5–5 μ, 1–6-septate. [FIG. 9.]

On leaves of **Cayaponia* sps.

The conidia of this fungus at times produce secondary conidia near the tips.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *3777* (type), Rosario; No. *4815*, Maricao. (These specimens were previously reported as *C. cucurbiticola* P. Henn.)

SECTION XX

Conidial scars distinct, over 2 μ in diameter, conidiophores simple, stroma tuberculate, conidia acicular-obclavate.

CERCOSPORA NICOTIANAE Ellis & Ev. Proc. Acad. Sci. Phila. **1893**: 170. 1893.—Sacc. Syll. Fung. **11**: 628. 1895.—Sturgis, Ann. Rep. Conn. Agric. Exp. Sta. **20**: 273–278, *pls. 7, 8, figs. 1–3*. 1897.—Eng. Bot. Jahr. **28**: 279. 1901.—Hedwigia **41**: 310. 1903.—Heald & Wolf, Bu. Pl. Ind. Bull. 226: 105. 1912.

—Bull. Soc. Path. Veg. Fr. **5**: 45. 1918. *Fig. 1, a–e.*—Welles, Am. Jour. Bot., **12**: 202. 1925.

Type locality: Raleigh, North Carolina.

Spots, amphigenous, circular to angular to irregular, more or less vein-limited and confluent, 0.5–5 mm., dark centered, the spots frequently appearing olivaceous to sooty due to the abundance of conidiophores; border definite, raised, blackish-brown to brown above, light-brown below. Mycelium internal and external: external mycelium arising from the internal and emerging with the conidiophores or arising directly from the conidiophores, subhyaline, 1.5–3 μ; internal mycelium hyaline to yellowish-brown, 1–6.5 μ. Conidiophores amphigenous, moderately to compactly tufted, rupturing the epidermis, straight to flexuous, geniculate, simple, arising from a fairly compact to tuberculate stroma, brown with reddish tinge, 20–285–(615) $\times$ 3.5–5 μ, continuous or 1–10–(20)-septate; conidial scars distinct, shouldered or laterally displaced. Conidia narrowly acicular, acute at tip, hyaline, 35–245 $\times$ 3–5 $\times$ 1.5–2 μ (secondary conidia 2.5–3.5 μ at base), 5–26-septate.

On leaves of **Nicotiana Tabacum* L., *N.* sps. and *N. repanda* Willd.

The specimen collected by J. A. Stevenson at Bayaman, Porto Rico, Herb. Univ. Ill. No. *5517* has for the most part very long straight, non-geniculate, many-septate conidiophores. The maximum numerical expressions of length and septation is recorded in the parentheses above. The ordinary conidiophores of the species were also found, the two types emerging together. It seems probable, therefore, that both types of conidiophores are common to the species. It is possible, however, that two different fungi are being dealt with.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *7270*, Quebradillas; No. *7980*, Dos Bocas; No. *7612*, Ste. Ana; No. *5517*, J. A. Stevenson, Bayamon, Porto Rico; Fungi Malayana No. *123*, Mt. Maquiling, near Los Baños, Province Laguna, Philippine Islands.

SECTION EUCERCOSPORA

Conidial scars distinct, over 2 μ in diameter, conidiophores simple, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia acicular-obclavate.

Cercospora Atkinsonii Stev. & Solh. sp. nov.

Syn. *Cercospora althaeina* Sacc. var. *Modiolae* Atkinson, Jour. Elisha Mitch. Soc. **8**: 60. 1891.—Underw. & Earle, Ala. Bull. **80**: 141. 1897.

Type locality: Alabama.

Spots amphigenous, circular to angular, vein-limited, 1–3 mm., olivaceous, becoming brown to grayish centered; border more or less indefinite, of a darker-brown than the spot proper. Mycelium internal, irregular, subhyaline, 2–6.5 μ, stromatic mycelium subhyaline to brownish. Conidiophores amphigenous, loosely to moderately tufted, emerging through the stomata or rupturing the epidermis, simple, straight, more or less geniculate, arising from a fairly compact stroma, subhyaline to brownish, 15–52 × 4.5–5 μ, continuous; conidial scars fairly distinct, shouldered. Conidia acicular, subhyaline, 50–105 × 3–3.5 × 1.5–2 μ, 5–11-septate. [FIG. 5.]

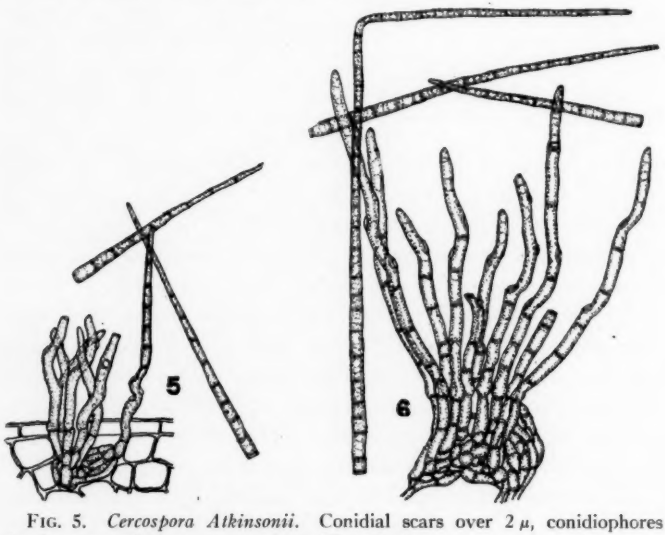


FIG. 5. *Cercospora Atkinsonii.* Conidial scars over 2 μ, conidiophores simple, stroma loose to compact, conidia acicular.

FIG. 6. *Cercospora malayensis.* Conidial scars over 2 μ, conidiophores simple, stroma loose to compact, conidia acicular.

On leaves of **Modiola multifida* Moench.

The type of the variety has not been seen but the material at

hand agrees very well with the description of it. It appears to be quite distinct from *C. althaeina* Sacc. having shorter conidiophores, acicular conidia and much narrower conidia. It is also distinct from *C. Modiolae* Tharp, which, from the description, has much thicker conidia and longer conidiophores. The new species is named after the author of the variety, the late Prof. Atkinson.

Specimens examined: Herb. Univ. Ill., Hawaiian Fungi No. *1047*, Waimea and No. *1082*, Hamakua, upper ditch trail. (These specimens were issued under *C. althaeina* Sacc., Bull. Bernice P. Bishop Mus., **19**: 154. 1925.)

CERCOSPORA ATRICINCTA Heald & Wolf, Mycologia **3**: 14. 1911.

Type locality: Victoria, Texas, 2506.

Spots amphigenous, subcircular to irregular, more or less vein-limited, 0.5–4 mm., at first brown, becoming dirty-white; border definite, raised, narrow, light-brown below, purplish- to blackish-brown above, frequently with a broad marginal discolored zone which is olivaceous below and purplish- to blackish-brown above. Mycelium internal and external: external mycelium hyaline to brownish, fine, 1.5–3 μ, internal mycelium hyaline to brownish, 1.5–6.5 μ, stromatic mycelium appearing reddish-brown in mass. Conidiophores amphigenous, moderately tufted, emerging through the stomata or rupturing the epidermis, straight to subgeniculate, arising from a fairly compact stroma, reddish-brown, 35–104 $\times$ 3.5–4.5 μ, 1–5-septate, simple or very rarely with opposite branches; conidial scars laterally displaced and more or less warty, or less commonly somewhat shouldered, fairly distinct. Conidia acicular, subhyaline to dilute-bluish or yellowish, 40–140 $\times$ 3.5–4 $\times$ 1.5–2 μ, 5–15-septate.

On leaves of **Zinnia* sp.

The original description describes the conidia as being dilute brownish and 100–200 $\times$ 4–4.5 μ.

Specimens examined: Herb. Univ. Ill. No. *3130*, J. A. Stevenson, Espinosa, Porto Rico.

CERCOSPORA CANESCENS Ellis & Martin, Am. Nat. **16**: 1003. 1882.—Ellis & Ev. Jour. Myc. **1**: 21. 1885; **3**: 19. 1887; **8**: 73. 1902.—Wint. & Dem. Hedwigia **24**: 203. 1885.—Sacc.

Syll. Fung. **4**: 435. 1886.—Atkinson, Jour. Elisha Mitch. Soc. **8**: 48. 1891.—Heald & Wolf, Bu. Pl. Ind. Bull. **226**: 37, *pl. 2, figs. 5–6; pl. 9, fig. 3.* 1912.—Schwarze, N. J. Agric. Exp. Sta. Bull. **313**: 132, *fig. 788.* 1917.

Type locality: Newfield, N. J.

Spots amphigenous, circular to angular to irregular, vein-limited, confluent, 0.5–8 mm., brown, reddish-brown, becoming grayish-brown to white centered; border definite, raised, rusty-brown to reddish-brown. Mycelium internal, hyaline, sub-hyaline to yellowish-brown, brown in stromata, 1.5–4 μ, up to 7 μ in stromata. Conidiophores amphigenous, moderately to fairly compactly tufted, emerging through the stomata or rupturing the epidermis, simple or rarely branched, with or without a bulbose base, subflexuous, geniculate, arising from a loose to compact stroma, brown to olivaceous, 20–175–210 $\times$ 3–6.5 μ, continuous or 1–7-septate; conidial scars distinct, shouldered or somewhat laterally displaced, mostly scattered. Conidia narrowly acicular to acicular-obclavate or at times somewhat cylindrical or fusiform, hyaline to greenish, 35–210 $\times$ 2.5–5 $\times$ 1–2.5 μ, 3–20-septate.

On leaves of **Phaseolus* sp., **P. lunatus* L., **P. vulgaris* L., **Vigna catjang* Walp., *V. glabra* Savi, *Amaranthus* sp., *Ricinus communis* L., and on dead stems of *Lycopersicum esculentum* Mill. and *Petunia parviflora* Juss.

Conidial measurements given above do not agree well with those of the original description. However, they agree with those given by Heald and Wolf who have based their determination on a comparison of their material with the specimens in the herbarium of the New York Botanical Garden.

Specimen No. *5130*, Herb. Univ. Ill., collected by J. A. Stevenson at Rio Piedras, Porto Rico, April 5, 1916, and recorded as *C. canescens* is not this species. The material was too poor to permit definite determination beyond this. This, as far as the authors know is the only record of *C. canescens* as occurring on *Dolichos Lablab* L.

Specimen No. *5835* of the same collector on *Vigna catjang* Walp., recorded as *C. canescens* is a *Helminthosporium.* The specimen was collected at Garrochales, Porto Rico, Dec. 2, 1916.

Specimens examined: As *C. cruenta* Sacc., Herb. Univ. Ill., ex Herb. F. L. Stevens No. *261*, Santuree, Porto Rico.—Seym.

& Earle, Ec. Fungi No. *507*, Auburn, Ala. As *C. Vignae* Racib (?), Herb. Univ. Ill., J. A. Stevenson No. *2110*, Rio Piedras, Porto Rico. As *C. canescens* Ellis and Mart., Herb. Univ. Ill., Porto Rican Fungi No. *5872*, Guayanilla; No. *32964*, ex Herb. U. S. Dept. Agric. D. V. P. P. No. *1199*, Manhattan, Kans.—Rabenh.-Winter, Fungi Eu. No. *3788*, Perryville, Mo.

CERCOSPORA ERECHTITIS Atkinson, Jour. Elisha Mitch. Soc. **8**: 66. 1891.—Sacc. Syll. Fung. **10**: 629. 1892.—Underw. & Earle, Ala. Agric. Exp. Sta. Bull. **80**: 145. 1897.—Stevens, Ill. Biol. Mon. **11**: 57–58. 1927.

Type locality: Auburn, Alabama.

Spots amphigenous, circular, 0.5–2 mm., brown, at times whitish centered: border definite, raised, about the same color as the spot, 100–150 μ. Mycelium internal and external: external mycelium hyaline to subhyaline, 1.5–3.5 μ; internal mycelium subhyaline to brown, 3–8 μ. Conidiophores amphigenous, solitary or moderately tufted, emerging through the stomata, rupturing the epidermis or effused on the external mycelium, straight to flexuous, at times geniculate, non-stromatic or arising from a loose stroma, reddish-brown, 30–140 $\times$ 3.5–5 μ, continuous or 1–6-septate, simple or rarely with either alternate or opposite branches; conidial scars distinct, laterally displaced and somewhat warty or shouldered. Conidia acicular, to acicular-obclavate, subhyaline, 45–140 $\times$ 2.5–4 $\times$ 1.5–2 μ, 6–20-septate.

On leaves of **Erechtites* sp. and *E. praealta* Rafin.

The original description records the conidiophores as being epiphyllous, 50–240 $\times$ 4 μ and the conidia 70–230 $\times$ 4 μ.

Specimens examined: Herb. Univ. Ill., Fungi of Costa Rica No. *556*. Experencia Farm.

CERCOSPORA PLANTAGINIS Sacc. Michelia **1**: 267. 1878; Fungi Ital. Pl. *666;* Syll. Fung. **4**: 454. 1886.—Ellis & Ev. Jour. Myc. **1**: 19. 1885.—Lindau in Rabenh. Krypt.-Fl. 1^9: 133. 1910, *fig.* p. 134.

Type locality: Italy.

Spots amphigenous, circular to angular to eliptical, somewhat vein-limited, 0.5–4 mm., brownish-gray to gray or whitish; border definite, raised, brown. Mycelium internal and external; external mycelium hyaline, fine 1–2 μ; internal mycelium sub-

hyaline to brown, frequently forming mats, 1.5–6.5 μ. Conidiophores amphigenous, loosely to moderately tufted, emerging through the stomata or at times rupturing the epidermis, simple, more or less geniculate, arising from a loose to compact stroma, brown, 30–140 × 3–5 μ, continuous or 1–3-septate, conidial scars distinct, laterally displaced or somewhat shouldered. Conidia acicular, subhyaline to hyaline, 40–200 × 2.5–3.5 × 1.5–2 μ, 6–20-septate.

On leaves of **Plantago* sp., **P. lanceolata* L., **P. major* L. and *P. lusitanica* L.

Specimens examined: Herb. Univ. Ill. No. *20076*, ex Herb. Mo. State Univ., Columbia, Mo., ex herb. F. L. Stevens, New Brunswick, N. J.; Hawaiian Fungi No. *433*, Upper Waimea Canyon, Kauai.

CERCOSPORA BLOXAMI Berk. & Br. Ann. Mag. Nat. Hist. V. **9**: 183. 1882; Cooke, Grevillea **11**: 14. 1882.—Sacc. Syll. Fung. **4**: 433. 1886.—Cooke, Fung. Pests, *pl. 7, fig. 97*.—Kirchner, Krankh. Kulturpfl. 306. 1906. Atlas 3: *pl. 12, figs. 1–2*.—Lindau in Rabenh. Krypt.-Fl. **9**: 98. 1910.—Heald & Wolf, Bu. Pl. Ind. Bull. 226: 38. 1912.—Young, Mycologia **8**: 43. 1916.—Ann. Myc. **22**: 193. 1924.

Type locality: Twycross, England, Berkeley, No. *1979*.

Spots amphigenous, circular to angular, more or less confluent, 1–5 mm., light-green, light-brownish to sordid-white; border definite, not raised or distinctly raised, brown. Mycelium internal and external: external mycelium rather sparse, emerging with the conidiophores, hyaline, 2–3.2 μ; internal mycelium hyaline, brown just below the conidiophores, 2–6.5 μ. Conidiophores amphigenous, loosely to fairly compactly tufted, emerging through the stomata or rupturing the epidermis, or at times arising from the external mycelium, simple or rarely alternately branched, straight to flexuous, more or less geniculate, arising from a loose stroma, dilute-brown to brown, 25–260 × 3.2–5.5 μ, continuous or 1–8-septate; conidial scars distinct, usually rather distantly spaced, shouldered. Conidia acicular to acicular-obclavate, straight or somewhat flexuous, greenish-hyaline, 25–200 × 2.5–3.5 × 1–2 μ, 3–22-septate.

On leaves of **Brassica* sp., **B. juncea* Coss., **B. nigra* Koch., *B. campestris* L. (*B. napus* L. and *B. Rapa* L.), *B. oleracea capitata* L.

Specimens examined: Seym. & Earle, Ec. Fungi *255*, New Brunswick, N. J. (Compared with original specimen by Prof. Geo. Massee.)—Herb. Univ. Ill. No. *6782*, Rio Piedras, Porto Rico, J. A. Stevenson; ex Herb. F. L. Stevens No. *449*, Bayamon, Porto Rico; No. *5121*, Quebradillas, Porto Rico.

CERCOSPORA ARCTI-AMBROSIAE Halsted, Bull. Torrey Club **20**: 251. 1893.—Seym. & Earle, Ec. Fungi No. *296*. 1893.

Syn. *Cercospora Arctii* Stevens, Bull. Bernice P. Bishop Mus., **19**: 154. 1925.

Type locality: *Cercospora Arcti-ambrosiae* Halsted, New Brunswick, N. J., Sept., 1892, F. L. Stevens, Seym. & Earle, Ec. Fungi *296*. *Cercospora Arctii* Stev. Hawaii: Kukuihaele, Herb. Univ. Ill., Hawaiian Fungi No. *1096*.

Spots amphigenous, angular, vein-limited, 1–3 mm., at first dark-brown, becoming gray to white centered; border more or less indefinite. Mycelium internal, regular to irregular, 1.5–7 μ, subhyaline to hyaline, stromatic mycelium subhyaline to brown, 3.2–9.8 μ. Conidiophores amphigenous, solitary to loosely to fairly densely tufted, emerging through the stomata or rupturing the epidermis, simple, straight to subflexuous, with a more or less bulbose base, non-stromatic or arising from a loose to fairly compact stroma, pale-brown to deep-brown, 25–220 $\times$ 3.5–5 μ, continuous, or 1–5-septate; conidial scars distinct, mostly over 2 μ in diameter, somewhat laterally displaced or prominently shouldered. Conidia acicular to slightly acicular-obclavate, pale greenish-yellow, 25–195 $\times$ 2.5–3.3 $\times$ 1.4–1.8 μ, 3–15–25-septate.

On leaves of **Arctium lappa* L. (wild and cultivated) and **Ambrosia trifida* L.

C. Arcti-ambrosiae Hals. has not been recorded in the Sylloge Fungorum. This no doubt accounts for the double nomenclature in this case.

Specimens examined: *C. Arcti-ambrosiae* Hals., Seym. & Earle, Ec. Fungi *296* (type), New Brunswick, N. J., and No. *297*, New Brunswick, N. J. *C. Arctii* Stev., Herb. Univ. Ill., Hawaiian Fungi No. *1096* (type), Kukuihaele.

CERCOSPORA POROPHYLLI Stev. & Moore, Ill. Biol. Mon. **11**: 58. 1927.

Type locality: Siquirres, Costa Rica, Herb. Univ. of Ill., Fungi of Costa Rica No. *554*.

Spots amphigenous, circular to angular, more or less vein-limited, 1.5–5 mm., above olive-green to dirty-brown, becoming cinereous, olive-green below; border definite, consisting of one or more narrow, raised ridges, smoky-brown, the whole surrounded by a purplish-brown discolored zone. Mycelium internal, hyaline to olive-brown, 2.5–5 μ. Conidiophores amphigenous, solitary or loosely tufted, rupturing the epidermis or emerging through the stomata, simple or very rarely branched, subflexuous, more or less geniculate, non-stromatic or loosely stromatic, brown, 35–105 $\times$ 3.2–5 μ, 1–2-septate; conidial scars distinct, laterally displaced and somewhat denticulate or shouldered. Conidia at first cylindrical, later acicular-obclavate, subhyaline, 30–70 $\times$ 3–4.5 $\times$ 2.5–3.5 μ, somewhat obscurely 1–7-septate.

On leaves of *Porophyllum ruderale* (L.) Cass.

The conidia of the species produce small secondary conidia at the tip or on short lateral projections near the tip.

Specimens examined: Herb. Univ. Ill., Fungi of Costa Rica No. *554* (type), Siquirres.

Cercospora malayensis Stev. & Solh. sp. nov.

Type locality: Mt. Maquiling, near Los Baños, Province Laguna, Philippine Islands, Fungi, Malayana No. *120*.

Spots in the nature of long, fairly broad, yellow to tan to brown streaks between the major veins of the leaf, frequently extending from the edge of the leaf to the midrib, the tissue shrivelling more or less and eventually dropping out leaving very ragged edges, the conidiophores forming dark-brown, sooty patches here and there on the discolored areas; border indefinite. Mycelium internal, hyaline to yellowish-brown, 1.5–5.5 μ, up to 11 μ in the stromata. Conidiophores amphigenous, moderately to compactly tufted, emerging through the stomata or rupturing the epidermis, straight to flexuous, at times somewhat geniculate, simple, arising from a loose to fairly compact stroma, olive-brown to brown with a reddish tint, 25–260 $\times$ 3–5 μ, continuous or 1–8-septate, conidial scars scattered, fairly large, distinct and somewhat shouldered or by lateral displacement becoming somewhat indistinct. Conidia acicular to acicular-obclavate, hyaline, 50–270 $\times$ 2.5–4 $\times$ 1–2.5 μ, somewhat obscurely 4–40-septate. [FIG. 6.]

On leaves of **Hibiscus esculentus* L.

The specimen examined was referred to *C. Hibisci* Tracy and

Earle by Saccardo. However it is quite distinct from this species as well as from *C. hibiscina* Ellis & Ev. It differs from both of these species in the nature of the effect on the host as well as having simple conidiophores and long, acicular conidia. *C. brachypoda* Speg. has short conidiophores, 5–10 × 3 μ and bacilliform conidia, 30–50 × 2–2.5 μ. *C. Hibisci-manihotis* P. Henn. has cylindrical, curved conidia, 20–60 × 4 μ. These characteristics of the latter species are quite distinct from those of the above described species.

Specimens examined: Herb. Univ. Ill., Fungi Malayana No. *120* (type), Mt. Maquiling, near Los Baños, Philippines.

CERCOSPORA CITRULLINA Cooke, Grevillea **12**: 31. 1883.—Ellis & Ev. Jour. Myc. **1**: 20. 1885.—Sacc. Syll. Fung. **4**: 452. 1886.—Atkinson, Jour. Elisha Mitch. Soc. **8**: 45. 1891.—Heald & Wolf, Bu. Pl. Ind. Bull. 226: 45. 1912.—Schwarze, N. J. Bull. **313**: 132. 1917. *Fig. 795.*

Type locality: South Carolina, Rav. Fungi Am. No. *589.*

Spots amphigenous, circular, 0.5–2–5 mm., brown, becoming whitish; border definite, slightly raised, dark-brown to purplish. Mycelium internal and external: external mycelium, regular, fine, 1.5–2.5 μ, subhyaline; internal mycelium irregular, olivaceous to fairly dark-brown, 2–6.5 μ. Conidiophores amphigenous, moderately tufted, rupturing the epidermis, simple, straight to flexuous, arising from a small, loose to compact stroma, reddish-brown, 45–200–385 × 4–5 μ, 2–15-septate; conidial scars distinct, laterally displaced or shouldered. Conidia acicular, subhyaline, 75–290 × 3–4 × 1.5–2 μ, somewhat faintly 7–35-septate.

On leaves of **Citrullus vulgaris* Schrad.

The original description records the conidiophores as being epiphyllous, and pale-olivaceous. While the specimen examined had amphigenous and fairly dark conidiophores it did not appear otherwise to differ from the original description and is no doubt an authentic specimen of the species under which it is recorded.

Specimens examined: Herb. Univ. Ill., No. *5446*, J. A. Stevenson, Pueblo Viejo, Porto Rico.

Cercospora Leonuri Stev. & Solh. sp. nov.

Type locality: Cartago, Costa Rica, Herb. Univ. Ill., Fungi of Costa Rica, No. *33.*

Spots amphigenous, circular to irregular, more or less vein-limited, rarely confluent, 0.5–2.5 mm., brown; border definite, slightly raised, 75–150 μ, somewhat darker brown than the spot above, same color as the spot below. Mycelium internal and external: external mycelium subhyaline, 2–4.5 μ; internal mycelium subhyaline to olivaceous, 3–6.5 μ. Conidiophores amphigenous, loosely to moderately tufted, emerging through the

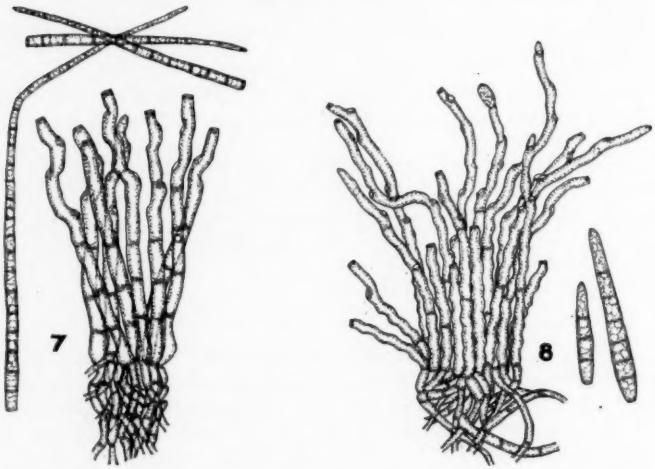


FIG. 7. *Cercospora Leonuri*. Conidial scars over 2 μ, conidiophores simple, stroma loose to compact, conidia acicular.

FIG. 8. *Cercospora verruculosa*. Conidial scars over 2 μ, conidiophores simple, stroma loose to compact, conidia abruptly obclavate.

stomata or rupturing the epidermis, simple, straight to subflexuous, more or less geniculate, frequently with bulbose bases, non-stromatic or arising from a small, loose to compact stroma, reddish-brown, 35–110 × 4.5–5.5 μ, 1–4-septate; conidial scars distinct, laterally displaced or shouldered. Conidia acicular, hyaline or greenish-hyaline, 60–270 × 2.5–4.5 × 1.5–2.5 μ, somewhat obscurely 7–35-septate. [FIG. 7.]

On leaves of **Leonurus cardiaca* L.

Specimens examined: Herb. Univ. Ill., Fungi of Costa Rica No. *33* (type), Cartago.

SECTION XXIV

Conidial scars distinct, over 2 μ in diameter, conidiophores simple, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia abruptly obclavate.

Cercospora verruculosa Stev. & Solh. sp. nov.

Type locality: St. Augustine, Trinidad, Herb. Univ. Ill., Fungi of Trinidad No. *829*.

Spots amphigenous, angular, more or less vein-limited, up to 1 cm., yellowish to tan to fairly dark-brown above, brown below; border definite, blackish-brown. Mycelium internal, hyaline, 1.6–5 μ, stromatic mycelium straw colored. Conidiophores hypophyllous, moderately to densely tufted, emerging through the stomata and rupturing the adjacent epidermis, straight below, verrucose, flexuous and geniculate above, simple or occasionally with both alternate and opposite branches, arising from a loose to fairly compact stroma, dilute olive-brown, 50–250 × 3.5–4.5 μ, continuous or 1–3-septate; conidial scars distinct, shouldered. Conidia abruptly obclavate to obclavate, subhyaline to dilute-yellowish, 35–70 × 5–8 × 3.5–5 μ, 2–6-septate. [FIG. 8.]

On leaves of **Caladium* sp.

Two conidia were observed germinating producing conidiophores directly.

This species is closely allied to *C. Callae* Peck & Cl. from which it differs in the much narrower, longer and verrucose conidiophores. It differs from *C. Caladii* Cooke in its much thicker conidia and from *C. pachyspora* Ellis & Ev. in its septate conidiophores, more slender and more septate conidia.

Specimens examined: Herb. Univ. Ill., Fungi of Trinidad No. *829* (type), St. Augustine.

CERCOSPORA MIKANIACOLA Stev. Trans. Ill. Acad. Sci., **10**: 213. 1917.

Type locality: Utuado, Porto Rico, Herb. Univ. Ill., Porto Rican Fungi No. *7923*.

Spots amphigenous, circular to somewhat angular, more or less vein-limited, 0.5–10 mm., above sordid-white in center, the spots enlarging by concentric zonation and the white center becoming surrounded by a dark brown zone which in turn is

surrounded by a grayish-brown zone and the whole surrounded by a blackish zone, similar below but the grayish-brown zone is usually not distinct; border more or less indefinite, rarely raised. Mycelium internal and external: external mycelium subhyaline, fine, 1.5–2.5 μ; internal mycelium subhyaline to yellowish to olivaceous, 1.5–5 μ. Conidiophores hypophyllous or rarely also epiphyllous, emerging through the stomata, solitary or loosely tufted, simple, geniculate, flexuous or rigid, non-stromatic, brown with a reddish tinge, 30–225 × 4.5–6.5 μ, 1–8-septate; conidial scars distinct, mostly scattered, shouldered, or less frequently somewhat laterally displaced. Conidia abruptly obclavate or at times somewhat fusiform, with a long whip-like tip, subhyaline to dilute-yellowish, 34–125–175 × 4–11 × 1–3.5 μ, 6–13-septate.

On leaves of **Mikania* sps.

A single conidium was seen germinating producing a conidiophore from the basal cell. The conidiophore was fairly dark-brown as compared with the subhyaline conidium. This indicates a genetic basis for the color of the conidiophore.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *7923* (type), Utuado; No. *4700*, Maricao; *5083*, Aguada; Fungi of British Guiana No. *24*, Georgetown.

SECTION XXX

Conidial scars distinct, over 2 μ in diameter, conidiophores with alternate branching, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia acicular-obclavate.

CERCOSPORA ALABAMENSIS Atkinson, Jour. Elisha Mitch. Soc., **8**: 51. 1891.—Tracy & Earle, Miss. Bull. **38**: 150. 1896.—Underw. & Earle, Ala. Bull. **80**: 141. 1897.—Sacc. Syll. Fung. **10**: 632. 1902.—Stev. Bull. Bernice P. Bishop Mus. **19**: 156. 1925.

Type locality: Alabama.

Spots amphigenous, circular, 1–5 mm., at first brown, becoming dirty-white; border definite, raised, brown, 150–400 μ. Mycelium internal, irregular, subhyaline to brown, 1.6–8.2 μ. Conidiophores amphigenous, loosely to fairly compactly tufted, emerging through the stomata or rupturing the epidermis, straight to subflexuous, arising from a loose to compact stroma, dilute reddish-brown, 35–140 × 4–5 μ, continuous or 1–5-septate,

mostly simple but occasionally monopodially branched, the branches for the most part being short but now and then long and well developed; conidial scars distinct, laterally displaced and somewhat denticulate or shouldered. Conidia acicular, straight or curved, subhyaline, 50–220 × 3–4 × 1.6–2.5 μ, 6–25-septate.

On leaves of *Ipomoea purpurea* Roth., *I. Pes-tigridis* L. and **I. biloba* Forsk.

The original description describes the border as dark-purple or black and the conidia up to 250 μ.

This fungus is very closely related to *C. Ipomoeae* Wint. and may prove to be the same or only a variety of it.

Specimens examined: Herb. Univ. Ill., Fungi of Costa Rica No. *617*, Puntarenas.

SECTION XXXVI

Conidial scars distinct, over 2 μ in diameter, conidiophores with alternate and opposite branching, stroma composed of loosely to fairly compactly interwoven hyphae or rarely none produced, conidia acicular-obclavate.

CERCOSPORA TECTONIAE Stev. Bull. Bernice P. Bishop Mus., **19**: 155. 1925.

Type locality: Oahu, Honolulu, Herb. Univ. Ill., Hawaiian Fungi No. *52*.

Spots amphigenous, angular, at times confluent. more or less vein-limited, 1–4 mm., brown to reddish-brown above, brown below, becoming ashen centered: border indefinite or at times definite, slightly raised or not raised, brown. Mycelium internal and external: external mycelium subhyaline to hyaline, 2–3 μ; internal mycelium subhyaline to yellowish-brown to olive-brown, 1.5–6.5 μ. Conidiophores hypophyllous, solitary or loosely tufted, emerging through the stomata or to a slight extent effused on the external mycelium, flexuous, somewhat geniculate, arising from a small stroma, brown with a reddish tinge, 35–175 × 3.2–5 μ, 1–7-septate, more or less branched, the branches both alternate and opposite; conidial scars distinct, laterally displaced or shouldered. Conidia acicular, hyaline, 45–175 × 3–4 × 1.5–2 μ, 7–15-septate.

On leaves of **Tectona grandis* L.

Specimens examined: Herb. Univ. Ill., Hawaiian Fungi No. *52* (type), Oahu: Honolulu, Hillebrand gardens.

CERCOSPORA FLAGELLARIS Ellis & Martin, Am. Nat. **16**: 1003. 1882.—Ellis & Ev. Jour. Myc. **1**: 18. 1885.—Sacc. Syll. Fung. **4**: 453. 1886.—Atkinson, Jour. Elisha Mitch. Soc. **8**: 46. 1891. —Stev. Trans. Ill. Acad. **10**: 212. 1917.

Type locality: Eastern United States.

Spots amphigenous, circular to angular, at times confluent, 0.5–10 mm., yellowish-brown above, becoming ashen centered, lighter colored below; border definite, raised, narrow, brown to reddish-brown above, yellowish-brown below. Mycelium internal and external: external mycelium subhyaline, 1–3 μ; internal mycelium subhyaline, brown in stroma, 1.5–5 μ. Conidiophores amphigenous, moderately to fairly compactly tufted, emerging through the stomata, or at times rupturing the epidermis above, subflexuous to flexuous, geniculate, stromatic, dilute-olivaceous to brown, 40–250 × 3.5–5 μ, 1–10-septate, more or less branched, the branches both opposite and alternate, well developed; conidial scars distinct, laterally displaced or shouldered. Conidia narrowly acicular, bacilliform, greenish, 35–280 × 2.5–3.5 × 1.5–2.5 μ, 4–20-septate.

On leaves of **Phytolacca decandra* L., **P. icosandra* L. and *Rivina humilis* L.

Specimens examined: Herb. Univ. Ill. No. *7314*, Mt. Carmel, Ill.; ex Herb. Mo. State Univ. No. *20227*, Columbia, Mo.; Porto Rican Fungi, No. *2323*, Maricao.—Seym. & Earle, Ec. Fungi *360a*, Jamesburg, N. J.; No. *360b*, Blue Ridge, Va.

DIDYMARIA CORDA

Didymaria boringuensis (Young) Stev. & Solh. comb. nov.

Syn. *Cercospora boringuensis* Young, Mycologia **8**: 45. 1916.

Type locality: Mayaguez, Porto Rico, Herb. Univ. Ill., ex Herb. F. L. Stevens No. *6752*.

Spots amphigenous, circular to angular, 1–7 mm., brown; border definite, not raised, brown, darker than spot. Mycelium internal and external: external mycelium subhyaline, 2–3 μ; internal mycelium subhyaline to dilute-olivaceous, 1.5–7 μ. Conidiophores amphigenous but mostly hypophyllous, loosely to moderately tufted, emerging through the stomata, more or less coremioid, simple, flexuous, non-stromatic or loosely stromatic, brown, 50–175 × 2.5–4 μ, 2–6-septate; conidial scars minute, mostly indistinct, laterally displaced or at times some-

what shouldered. Conidia clavate, straight or curved, dilute-olivaceous, 25–55 × 2.5–3.5 × 4–6.5 μ, 1–7-septate.

On leaves of **Calopogonium orthocarpum* Urb.

Specimens examined: Herb. Univ. Ill., ex Herb. F. L. Stevens No. *6752* (type), Mayaguez, Porto Rico.

Didymaria conjugans Stev. & Solh. sp. nov.

Type locality: Tumatumari, British Guiana, Herb. Univ. Ill., Fungi of British Guiana No. *54*.

Spots amphigenous, irregular, more or less confluent, 2–8 mm., rusty-brown, becoming tan centered; border indefinite. My-

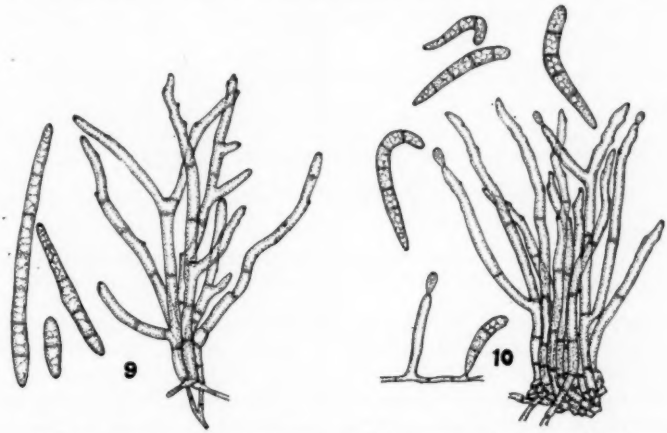


FIG. 9. *Cercospora Cayaponiae*. Conidial scars minute, conidiophores with alternate and opposite branching, stroma none, conidia cylindrical.
FIG. 10. *Didymaria conjugans*.

celium internal and external: external mycelium subhyaline to olivaceous, fine, 1.2–2 μ; internal mycelium subhyaline to olive-brown, fine, 1.5–3.5 μ. Conidiophores amphigenous but mostly hypophyllous, moderately to compactly tufted, emerging through the stomata or effused on the external mycelium, flexuous, arising from a compact to tuberculate stroma, olivaceous, 35–150 × 3–4 μ, 2–5-septate, branched, the branches long and well developed, alternate; conidial scars minute, laterally displaced or at times slightly shouldered. Conidia clavate, crooked, olivaceous, 25–50 × 2–3.5 × 4.5–5.5 μ, 1–5-septate. [FIG. 10.]

On leaves of an unknown Legume.

Specimens examined: Herb. Univ. Ill., Fungi of British Guiana No. *54* (type), Tumatumari.

Ragnhildiana Solheim, gen. nov.

Conidiophores tufted, emerging through the stomata or rupturing the epidermis, or effused on an external mycelium, simple or monopodially branched, more or less geniculate, straight or flexuous, continuous or septate, arising from a loose to compact or tuberculate stroma, hyaline to dark-brown. Conidia catenulate, acrogenous, at times appearing lateral due to further development of the conidiophores, cylindrical, continuous or several-septate, hyaline to dark-brown.

The type species is *Ragnhildiana Agerati* (Stevens) Stevens and Solheim.

This genus is intermediate between *Cladosporium* and *Cercospora*.

Ragnhildiana Agerati (Stevens) Stev. & Solh. comb. nov.

Syn. *Cercospora Agerati* Stev. Bull. Bernice P. Bishop Mus., **19**: 154. 1925.

Type locality: Hawaii: Kealakekua, Herb. Univ. Ill., Hawaiian Fungi No. *944*.

Spots somewhat indefinite, irregular, more or less confluent, vein-limited, yellowish-brown to brown above, smoky-brown below; border indefinite. Mycelium internal and external: external mycelium regular, subhyaline, fine, 2–3 μ; internal mycelium fairly regular, hyaline, subhyaline, or brownish in stromata, 1.4–2.5 μ. Conidiophores amphigenous but mostly hypophyllous, loosely to moderately tufted or effused on the external mycelium, emerging from the stomata, flexuous, arising from a small loose stroma, hyaline, subhyaline to dilute-brown, 25–70 $\times$ 3–5 μ, attenuated toward bases, continuous or 1–4-septate, much branched, the branches of monopodial origin and well developed; conidial scars fairly distinct, laterally displaced or slightly shouldered. Conidia catenulate, cylindrical, subhyaline, 15–52 $\times$ 2.5–4 μ, continuous or 1–4-septate. [FIG. 11.]

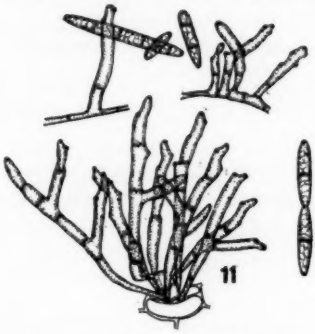
On leaves of **Eupatorium repandum* Willd. (*Ageratum conyzoides*.)

Specimens examined: Herb. Univ. Ill., Hawaiian Fungi No. *944* (type), Kealakekua; No. *750*, Wailuku River.

Ragnhildiana Cyathulae Stev. & Solh. sp. nov.

Type locality: Coverden, British Guiana, Herb. Univ. Ill., Fungi of British Guiana No. *743*.

Spots amphigenous, circular, 0.5–1.5 mm., brown, or black with brown centers above, similar below but appearing olive-brown due to the conidia and conidiophores; border indefinite.



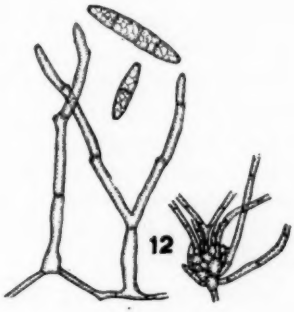


FIG. 11. *Ragnhildiana Agerati.*

FIG. 12. *Ragnhildiana Cyathulae.* To the left, conidiophores and conidia; to the right, internal mycelium with external mycelium arising from it.

Mycelium internal and external: external mycelium arising from the internal and emerging through the stomata, subhyaline to brown, 1.5–5 μ; internal mycelium forming scattered dense mats with connecting hyphae, light smoky to brown, 2.5–7 μ. Conidiophores hypophyllous, arising from the external mycelium, creeping, branched, flexuous, brown, 50–200 $\times$ 3–5 μ, 2–6-septate; conidial scars distinct, borne singly at the upper end of the cell from which the sympodial branch arises. Conidia cylindrical, catenulate, subhyaline to smoky, 15–45 $\times$ 4–7 μ, 1–3-septate. [FIG. 12.]

On leaves of **Cyathula achyranthoides* Moq.

Specimens examined: Herb. Univ. Ill., Fungi of British Guiana No. *743* (type), Coverden.

Ragnhildiana gonatoclada (Sydow) Stev. & Solh. comb. nov.

Syn. *Cercospora gonatoclada* Sydow, Ann. Myc. **23**: 425. 1925.

Type locality: La Caja near San Jose.

Spots somewhat indefinite, the conidiophores forming dark circular patches on the lower surface of the leaves, the upper

surface of the leaves becoming light-green to yellowish; border indefinite. Mycelium internal, hyaline to yellow, 2–3.5 μ. Conidiophores hypophyllous, covering the whole spot, moderately to fairly densely tufted, emerging through the stomata, straight to subflexuous, more or less geniculate, arising from a loose to fairly compact stroma, smoky-brown, 30–110 × 3.5–5.5 μ, 1–7-septate, branched, the branches alternate and well developed, usually arising near the bases; conidial scars distinct, laterally displaced or shouldered. Conidia cylindrical, catenulate, subhyaline to dilute-brownish, 25–60 × 4–5.5 μ, continuous 1–3–5-septate.

On leaves of **Iresine paniculata* (L.) O. and *I. calea* (Iban.) Standl.

Both conidia and conidiophores were observed anastamosing.

This fungus was originally published under *Cercospora Gilbertii* Speg., Trans. Ill. Acad. Sci. **10**: 211. 1917. It differs from this species in having branched, septate conidiophores and thicker, catenulate conidia.

Specimens examined: Herb. Univ. Ill., Porto Rican Fungi No. *8286* (type), Bandera.

Ragnhildiana Manihotis Stev. & Solh. sp. nov.

Type locality: Penal Settlement, British Guiana, Herb. Univ. Ill., Fungi of British Guiana, No. *683*.

Spots amphigenous, scattered, circular to irregular, more or less vein-limited, 0.5–3–6 mm., at first brown, becoming pure white above, similar below but with centers remaining somewhat brownish; border definite, raised, brown, 150–500 μ. Mycelium internal and external: external mycelium subhyaline, fine 1.5–2 μ; internal mycelium irregular, subhyaline, 2–5.5 μ, stromatic mycelium brownish. Conidiophores amphigenous but mostly hypophyllous, moderately tufted, emerging through the stomata, straight to flexuous, intertwined, geniculate, stromatic, olive-brown to reddish-brown, 40–200 × 3.5–5 μ, 1–6-septate, simple or quite frequently branched, the branches both alternate and opposite, when opposite subtending a conidial scar; conidial scars distinct, shouldered. Conidia catenulate, obclavate to cylindrical, hyaline, 15–45 × 4–8 × 3–4.5 μ, continuous or 1–3-septate.

On leaves of **Manihot utilissima* Pohl.

The following specimens formerly reported from Porto Rica as *C. Henningsii* Allesch. belong under this species:

Santuree, *254;* Hormigueras, *223;* Bayamen, *3932.* One reported from Dos Bocas, *6557* as *C. Cassavae* Ellis & Ev. also belongs here.

Specimens examined: Herb. Univ. Ill., Fungi of British Guiana No. *683* (type), Penal Settlement; Porto Rican Fungi No. *254*, Santuree; No. *223*, Hormigueras; No. *3932*, Bayaman; No. *6577*, Dos Bocas; Fungi of Panama No. *1181*, Frijoles.

Ragnhildiana Tremae Stev. & Solh. sp. nov.

Type locality: St. Clair, Trinidad, Herb. Univ. Ill., Fungi of Trinidad No. *889.*

Spots amphigenous, circular to irregular, 3–5 mm., grayish-brown center surrounded by a dark-brown to purplish-brown zone which in turn is surrounded by a zone which is reddish-brown above and brown below; border indefinite. Mycelium internal, hyaline, olivaceous to brown, irregular, 2–4 μ. Conidiophores hypophyllous, loosely to moderately tufted, emerging through the stomata or rupturing the epidermis, also arising from the trichomes, simple or at times branched, straight, more or less geniculate, stromatic, olivaceous, 20–60 $\times$ 3–4.5 μ, 1–3-septate; conidial scars minute, distinct, laterally displaced or shouldered. Conidia cylindrical, catenulate, dilute olive-green, 25–55 $\times$ 2–3.5 $\times$ 2–3 μ, 1–5-septate.

On leaves of **Trema micrantha* Blume.

Specimens examined: Herb. Univ. Ill., Fungi of Trinidad, No. *889* (type), St. Clair.

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NOTES AND BRIEF ARTICLES

Dr. B. O. Dodge has just turned over to the Mycological Department of The New York Botanical Garden one hundred specimens of fungi "Herbarium Mycologicum Romanicum" issued by Professor Dr. Tr. Săvulescu of Roumania. These specimens are unusually well put up with descriptive labels and are a valuable addition to our collection of exsiccati.

Mr. John A. Stevenson, Mycologist of the Bureau of Plant Industry, Washington, D. C., spent several days at the Garden in March looking over fungi belonging to the family Perisporiaceae. Mr. Stevenson formerly spent several years in Porto Rico and is especially interested in this group of fungi, most of which are tropical.

Dr. Alfred H. Povah has been appointed Park Naturalist of Yellowstone National Park, with headquarters at Mammoth Hot Springs. The other permanent members of the Educational Staff are Dorr G. Yeager, Assistant Park Naturalist, and Miss Herma Albertson, Junior Park Naturalist. The educational program of conducted trail trips, lectures at hotels, lodges and auto camps as well as museum duty will be carried out by this staff assisted by a temporary staff of twenty-two ranger naturalists.

At the Fifth International Congress held at Cambridge, England, 1930, it was decided by an overwhelming majority to retain the rule adopted at a previous convention (1905) that the publication of names of new groups would be valid only when accompanied by a Latin diagnosis. The date on which the rule was to become effective was changed from January 1, 1908, to January 1, 1932. By a diagnosis is meant not necessarily a long detailed description but a concise statement of the leading diagnostic characters. Contributors to MYCOLOGIA are requested to comply with this provision. Each author will be responsible for his own Latin.

Doctor C. H. Kauffman, Emeritus Professor of Botany and Emeritus Director of the University Herbarium of the University of Michigan, died at his home in Ann Arbor, Michigan, the morning of June 14 after a sickness of sixteen months as the result of a paralytic stroke in February 1930. He was sixty-two years of age.

Dr. Kauffman came to the University of Michigan as an Instructor in Botany in 1904. He was made Assistant Professor in 1910, Associate Professor in 1920, Professor in 1923. In 1921 he became Director of the University Herbarium. He was absent on leave from 1917–1919 during which time he served as Pathological Inspector on the Federal Horticultural Board, United States Department of Agriculture.